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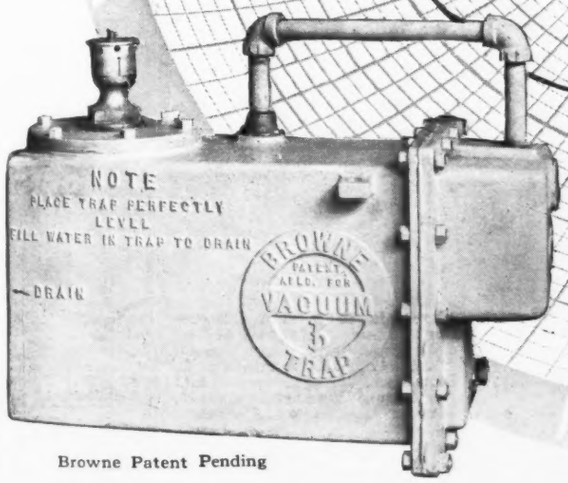

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The Heating and Ventilating Magazine

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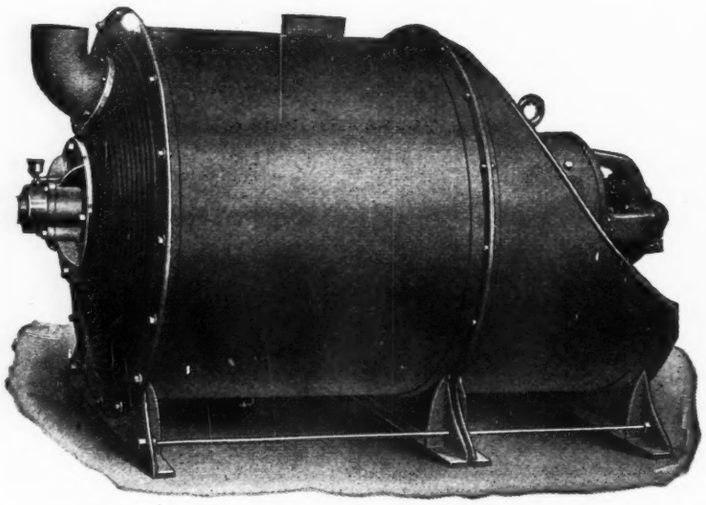

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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress.

MARCH, 1923

Formulas for Calculating Friction Heads in Water Pipes

What is wrong with those Commonly Used and How They Should be Modified to Fit Actual Conditions

By F. E. Giesecke

Head, Engineering Research Division, University of Texas.

EXPERIMENTS relating to the flow of water through pipes prove that it requires a certain force to produce such a flow and that a portion of this force is consumed in overcoming the friction between the water and the pipe, and the friction in the water itself.

The value of that portion of the force which is consumed in overcoming friction, called the friction head, may be expressed in pounds per square inch or in feet of a water column exerting an equal pressure, or in other similar units.

It can also be proven experimentally that, for any given case, the friction head is proportional to the length of the pipe, and, approximately, to the square of the velocity of the water, and, approximately, inversely proportional to the diameter of the pipe.

We may therefore write

$$h = k \frac{L}{D} v^2 \qquad (1)$$

where h is the friction head, i. e., the loss of pressure, in pound per square inch, for example, due to the friction in the pipe; k is a constant, determined by experiment for each particular case; L and D are, respectively, the length and diameter of the pipe in feet, or other similar units; and v is the velocity of the water in feet per second.

Or we may write:

$$h = f \frac{L}{D} \frac{v^2}{2g} \qquad (2)$$

where h is the friction head in feet of a column of water of the same density as that flowing through the pipe; f is a constant, determined by experiment for each particular case: L, D, and v are units as described above; and g is the acceleration due to gravity, i. e., 32.2 feet per sec.^{2}

Of the two friction head formulas quoted above, the second one is generally preferred; for this formula the older investigators and engineers considered f to be constant and equal to 0.0303 and wrote

$$h = 0.0303 \frac{L}{D} \frac{v^2}{2g} \qquad (3)$$

The Cox formula for friction heads in water pipes has been widely used in American heating practice. It is quoted in Harding and Willard's "Mechanical Equipment of Buildings" and is also to be found in two text books on algebra. In view of the fact, as Professor Giesecke points out, that the formula is nothing more than an inferior reproduction of the Weisbach formula, its wide use is remarkable, to say the least. "The general result of my study in the preparation of this article," writes Professor Giesecke, "has convinced me that my Formula No. 11 compares very favorably with any other formula published anywhere." In order to use it with ease, it should be reduced to a set of curves. This has been done by Professor Giesecke and the curves themselves will be presented in a subsequent article.

VELOCITY OF WATER AN IMPORTANT FACTOR.

Later it was discovered that the value of f was not constant but depended on the velocity of the water, and it was believed that the value of f could be expressed by a $+b/v$, where a and b are constants de-

termined by experiment and v is the velocity of the water.

In accordance with this view, Baron G. C. Prony (1755-1839) wrote

$$h = (0.0273 + 0.0146/v) \frac{L}{D} \frac{v^2}{2g} \qquad (4)$$

and Prof. J. A. Eytelwein (1764-1848) wrote

$$h = (0.022 + 0.0811/v) \frac{L}{D} \frac{v^2}{2g} \qquad (5)$$

Later Prof. J. Weisbach (1806-1871) made an exhaustive study of all experimental data available at that time and conducted a number of experiments himself, and concluded that the value of f could be expressed more accurately by a + b/$\sqrt{v}$ than by a + b/v and he wrote

$$h = (0.0144 \times 0.0172/\sqrt{v} \frac{L}{D} \frac{v^2}{2g} \qquad (6)$$

LIMITATIONS OF WEISBACH FORMULA

Prof. Weisbach's formula has been exceedingly popular; it was used by Prof. Rietschel in his text-book on heating and ventilating until the fifth edition was published in 1913, and it is still being used by many American engineers and writers, both in its original form and in modified forms as shown, for example, by Mr. Cox's formula (13) discussed below.

However, it has been known for a number of years that the value of f depends not only on the velocity of the water but also on the diameter of the pipe, and that, therefore, formulas Nos. 3, 4, 5, and 6, quoted above, give correct values only for a limited number of special cases.

The values calculated by Prof. Weisbach's formula, for example, are too low for small pipes and too high for large pipes.

Prof. G. H. L. Hagen (1797-1884) realized that f is a function of v and of d and proposed the formula

$$h = k \frac{L\ v^n}{d^x} \qquad (7)$$

or, for water flowing in a wrought-iron pipe,

$$h = 0.00712 \frac{v^{1.75}}{d^{1.21}} \qquad (8)$$

where h is the friction head per foot of pipe and d is the diameter, in inches. Prof. Hagen's formula agrees remarkably well with later determinations but evidently did not receive the publicity it deserved.

When Prof. Rietschel found that the values derived from Prof. Weisbach's formula were not as accurate as he desired them, particularly for calculations for the design of gravity water heating systems, he planned a very exhaustive study of the friction of water in pipes and fittings; this investigation was begun under his direction at the Technische Hochschule at Berlin and completed, after his death, by his successor, Dr. Brabbee.

THE BRABBEE TESTS.

The methods employed in this investigation and the results secured therefrom are described, in considerable detail, by Dr. Brabbee in *Gesundheits Inginieur* of July 26, 1913.

Dr. Brabbee's investigation was conducted with two types of iron pipes; the first type (Muffen pipes) included all pipes smaller than about 2½ in., the second type (Siede pipes) included all pipes larger than about 2½ in.

The two types are evidently manufactured by different processes so that the inner surfaces have different degrees of roughness and therefore different frictional resistances.

Dr. Brabbee found

$$\text{for Muffen pipes} \quad h = 0.00634 \frac{v^{1.78}}{d^{1.298}} \qquad (9)$$

$$\text{for Siede pipes} \quad h = 0.00796 \frac{v^{1.80}}{d^{1.41}} \qquad (10)$$

as average values, when the temperature of the water was about 59° F. and the head expressed in feet of water, not of the same density as that flowing through the pipe but of the density of water at 39.2 degrees.

Prof. Brabbee found that the exponent of v was not constant but increased slightly as the diameter of the pipe decreased.

TESTS AT UNIVERSITY OF TEXAS.

The writer of this article, who had studied under Prof. Rietschel in 1906-07, realized the importance of an accurate determination of the friction of water in standard American pipes and fittings for use in the design of gravity water heating systems and conducted a number of tests at the Texas Agricultural and Mechanical College in 1911 and 1912, with various pipes and fittings and published the results in *Domestic Engineering*, Nov. 2, 1912.

Later he resumed and extended the investigation at the University of Texas and published the results in University of Texas Bulletin No. 1715, The Friction of Water in Pipes and Fittings and in Transactions A. S. H. and V. E. Vol. XXIII, 1917, page 499.

The writer found for new and clean standard black pipe and for water having a temperature of about 68° F.:

$$h = 0.00685 \frac{v^{1.79} d^{0.04}}{d^{1.275}}$$

$$\text{or, approximately,} \quad h = 0.00685 \frac{v^{1.77}}{d^{1.275}} \qquad (11A)$$

This formula is quite similar to Prof. Hagen's formula, (6) and also to Dr. Brabbee's formulas (9 and 10).

It is evident that formulas Nos. 6, 9, 10, or 11 may be written

$$h = k\ v^n \qquad (12)$$

so long as they are to be applied to one particular pipe size only.

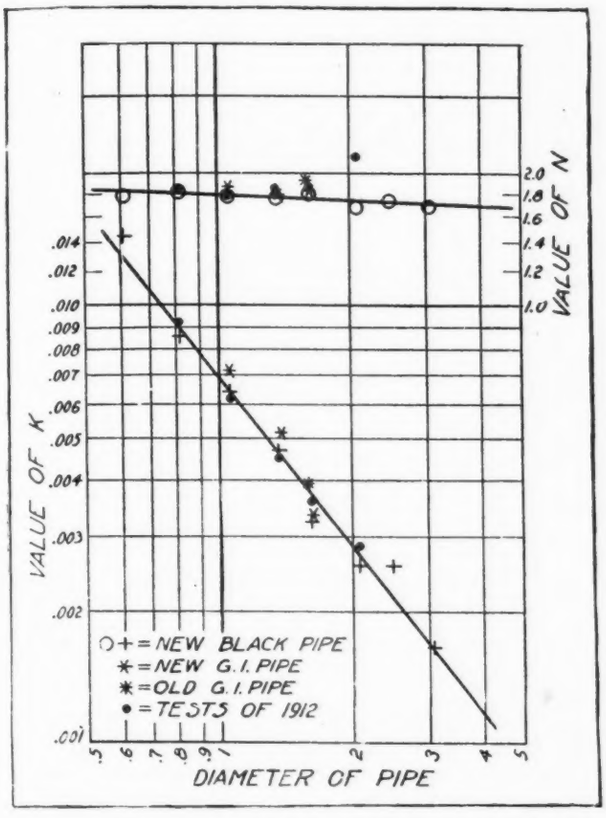


FIG.1—DATA FROM WHICH PROFESSOR GIESEKE'S FORMULA (11) WAS DERIVED

The values of k and n may be determined experimentally and plotted on logarithmetic paper against the diameter of the pipe, as shown in Fig. 1, which is a reproduction from Bulletin No. 1715.

This figure shows that the determinations made by the writer at the Texas Agricultural and Mechanical College agree well with those made by him several years later at the University of Texas. It also shows that the values of k and n are exponential functions of the diameter and that it is probably safe to apply formula No. 11 to pipe sizes somewhat larger and to velocities somewhat higher than those tested by the writer.

HOW THE WRITER'S METHOD OF TESTING DIFFERS FROM THAT OF DR. BRABBEE.

The method of testing used by the writer differs considerably from that used by Dr. Brabbee.

Dr. Brabbee caused the water to flow through the pipe to be tested by means of a pump, and determined the friction head by measuring the loss in pressure in a section of pipe 8.2 ft. long by means of three monometers, one using water, one mercury, and one oil; the velocity of the water was determined by two methods; for the Muffen pipe test, the quantity of water flowing through the pipe was weighed; for the Siede pipe test, the quantity of water was ascertained by means of a calibrated Siemens meter. In both cases the friction head was expressed in feet of a column of water having a temperature of 39.2°F.

In the writer's tests, the water was allowed to flow from one tank, through the pipe to be tested, into a second tank, in which the water was maintained at a lower level than in the first tank. The difference in elevation of the water in the two tanks was the head producing flow, and that head was carefully measured. The section of pipe for which the friction head was determined was about 25 ft. long; the velocity heads and other friction heads were carefully eliminated, as fully explained in the publications named above. The velocity of the water was determined, in all cases, by weighing the quantity of water flowing through the pipe in a given time; the friction head is expressed in feet of a column of water having the same density as that flowing through the pipe.

In order to compare the writer's formula, No. 11, with Prof. Weisbach's formula, No. 6, it is necessary to reduce No. 11 to the same form as No. 6 and to calculate the values of f for the several values of v, and for every value of D.

COMPARISON OF FORMULAS AS SHOWN BY CURVES

This was done and the results are shown diagrammatically in Fig. 2. It appears from that diagram that if the values determined by the writer are accurate,

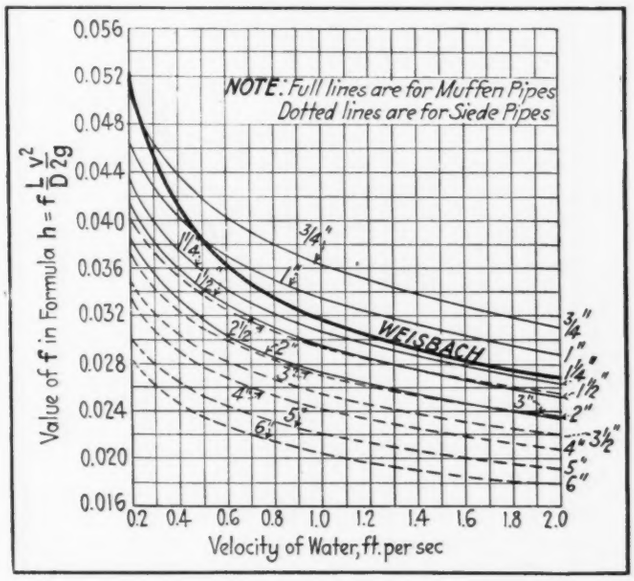

NOTE: Full lines are for Muffen Pipes
Dotted lines are for Siede Pipes
WEISBACH
Value of f in Formula $h = f\frac{L}{D}\frac{v^2}{2g}$
Velocity of Water, ft. per sec

FIG. 2.—A COMPARISON OF PROFESSOR GIESECKE'S FORMULA (11) WITH PROFESSOR WEISBACH'S (6).

Prof. Weisbach's formula gives values which are practically correct for a 1½ in. pipe, too low for smaller pipes and too high for larger pipes. For example, for a velocity of 2 ft. per second, and a 3/4 in. pipe, the friction head is about 27% higher and for a 4-in. pipe it is about 23% lower than that calculated by Prof. Weisbach's formula.

In order to compare the writer's formula No. 11 with Dr. Brabbee's formulas (Nos. 9 and 10), it is necessary to calculate the values of f for formulas Nos. 9 and 10 and to plot them as shown in Fig. 3 for comparison with these calculated for No. 11 and shown in Fig. 2.

A comparison of Fig. 3 with Fig. 2 shows that Dr. Brabbee's values are somewhat lower than the writer's, possibly, on an average, about 9%. A small part of

this difference is accounted for by the fact that Dr. Brabbee expresses the friction head in water of maximum density, whereas the writer expresses friction heads in water having the same density as that flowing through the pipes. In the cases shown in Fig. 2 and 3 this would make a difference of only about one-fourth of 1%.

A study of Fig. 3, which contains values for Muffen pipes from 3/4 to 2 in. and for Seide pipes from 2½

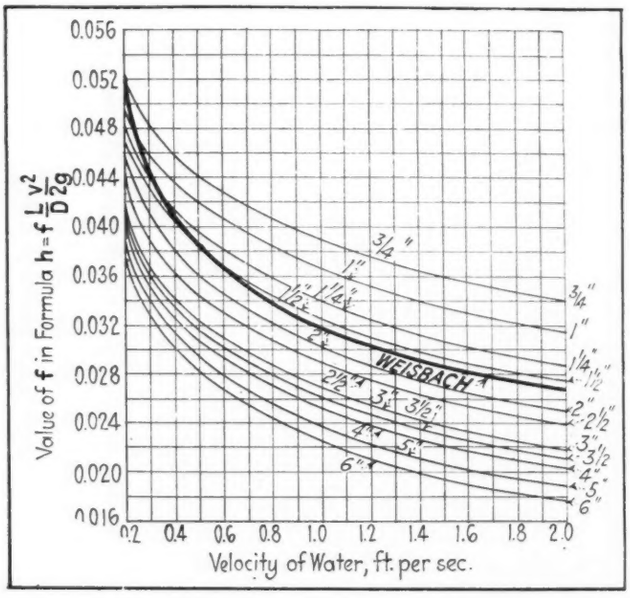


FIG. 3—A COMPARISON OF DR. BRABBEE'S FORMULAS (9 AND 10) WITH PROFESSOR WEISBACH'S (6).

to 6 in. shows that there is considerable difference between the friction in the two types of pipe. The difference in friction head, however, is not as great as the difference in the values of f shown in Fig. 2 because the friction heads are proportional to f/D and not to f only.

It also shows that the Weisbach formula gives values which are practically correct for a 1 1/4 in. Muffen pipe when the velocity is higher than 1 ft. per second.

WHERE THE COX FORMULA FAILS

Since it is somewhat inconvenient to apply formulas like Nos. 11, 10, 9, or 8 or like No. 2 with a variable value of f, when the same have not been reduced to a set of curves or to a tabulation of values for different cases, attempts have been made to replace them by more simple formulas.

One interesting case of this kind is Mr. William Cox's formula

$$h = \left(\frac{4\,v^2 + 5\,v - 2}{1200} \frac{L}{D} \right) \quad (13)$$

which was proposed about 1913 as the practical equivalent of Prof. Weisbach's formula No. 6.

The values calculated by means of this formula agree remarkably well with those derived from Prof. Weisbach's formula so long as the velocities are higher than 1 ft. per second; for lower velocities the Cox formula fails completely and it seems to the writer that this formula should not be published without calling attention to this defect in the formula.

In order to compare the Cox formula with Prof. Weisbach's, it is only necessary to transform both to the type of formula No. 2 and to plot the values of f against the corresponding values of v, as shown in Fig. 4, from which figure it is evident that for velocities higher than 1 ft. per second, the two formulas give practically identical results and that, for lower velocities, the Cox formula fails completely.

In order to simplify the calculations as much as possible, some engineers and writers still use formulas like No. 3.

One such formula is:

$$\text{Cubic ft. per minute} = 0.16 \sqrt{\frac{(3d)^5 \times 3\,h}{L}} \quad (14)$$

and, therefore,

$$h = 0.03088 \frac{L}{D} \frac{v^2}{2g} \quad (15)$$

from which it appears that formula No. 14 is based on a constant value of f of 0.03088. This value is represented in Fig. 4 by a dotted horizontal line intersecting the Weisbach curve at the velocity of 1.1 ft. per second, which shows that formula No. 14 gives lower values than

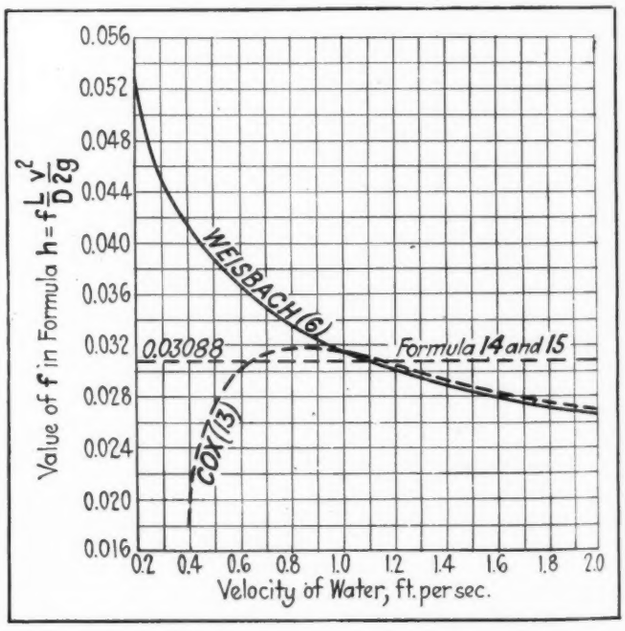


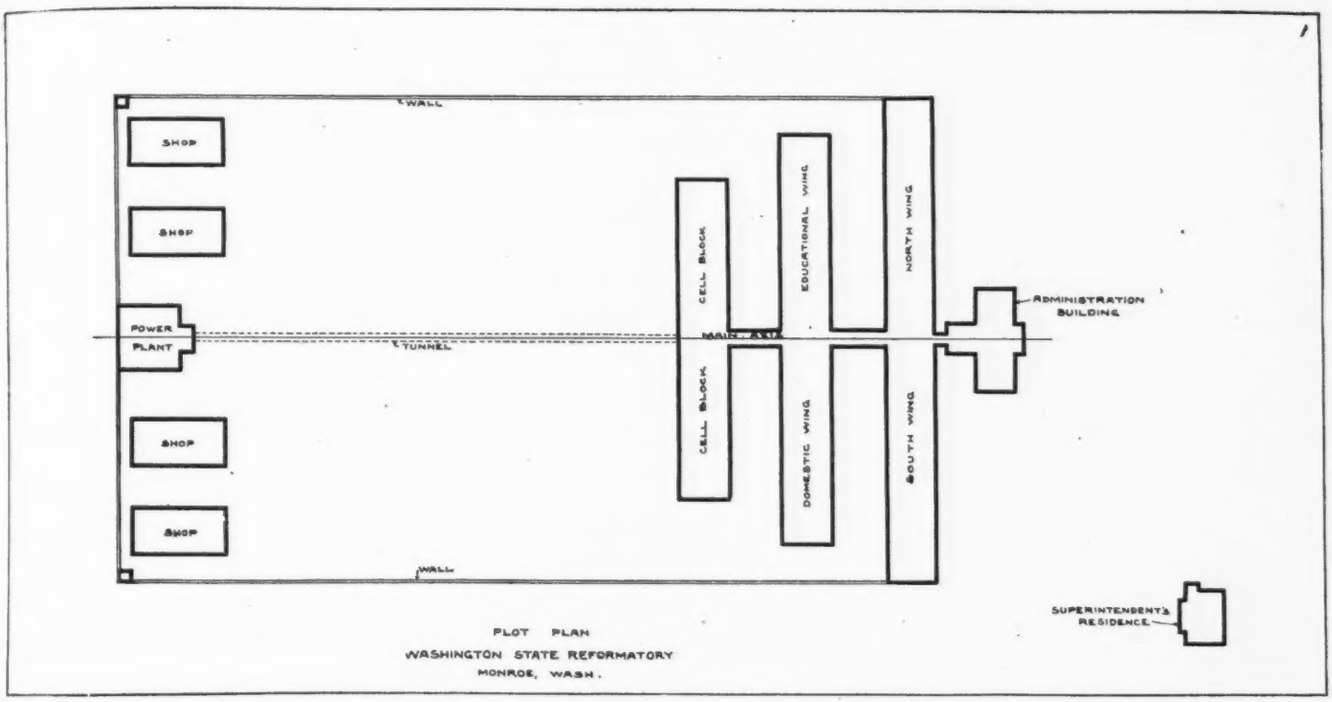
FIG. 4—A COMPARISON OF THE COX FORMULA (13) AND OF FORMULAS (14 AND 15) WITH PROFESSOR WEISBACH'S (6)

Prof. Weisbach's formula for velocities lower than 1.1 ft. and higher values for velocities higher than 1.1 ft. per second.

The inaccuracy in formula No. 15 exists also in formula No. 14.

The close agreement of formulas Nos. 8, 9, 10, and 11 proves that we are able to calculate the friction head of water in new and clean iron pipes very accurately.

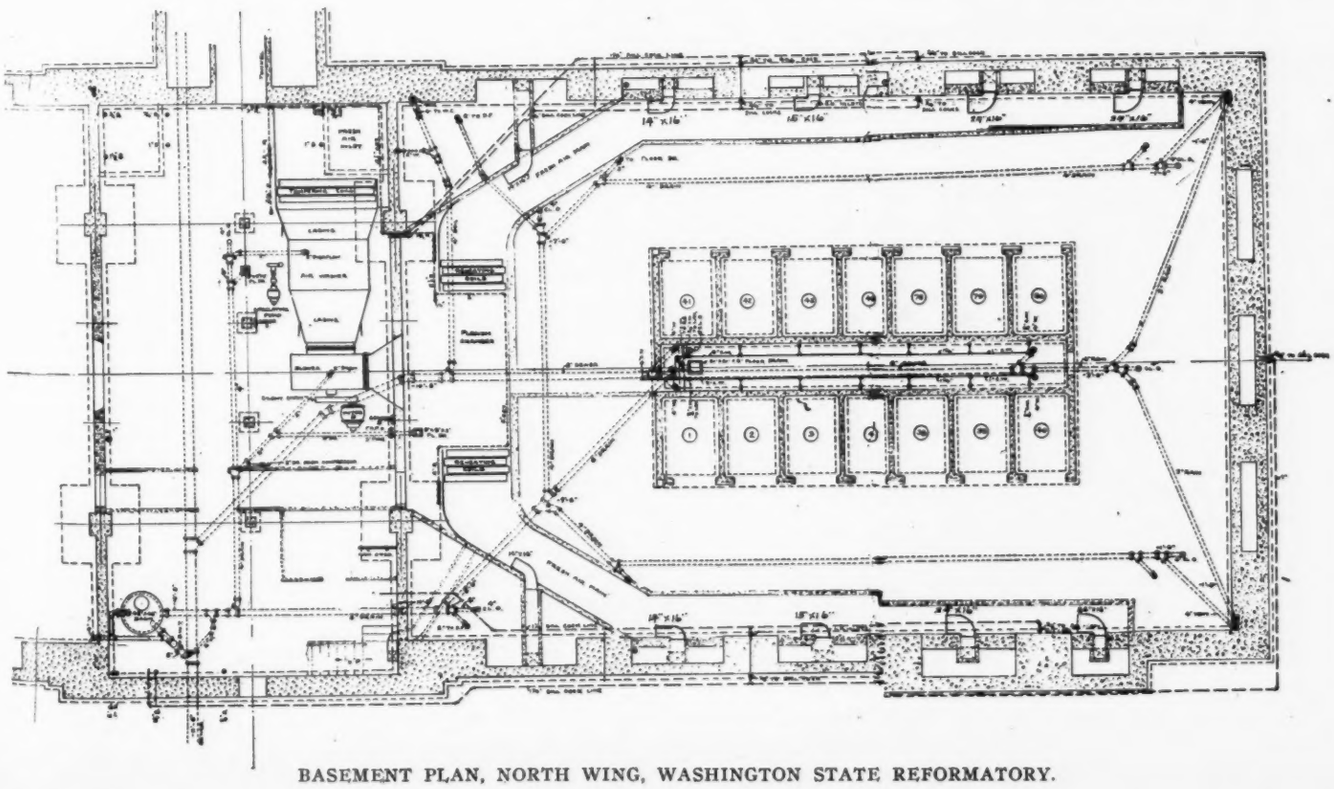
NOTE—Except when otherwise stated, the principal formulas and constants quoted above are from Encyclopædia Brittanica. In most cases, the original formulas were expressed in metric units or in forms slightly different from those quoted above. In order to simplify and abbreviate the discussion, all formulas were translated into American units and transformed into our standard forms before being incorporated in the article.



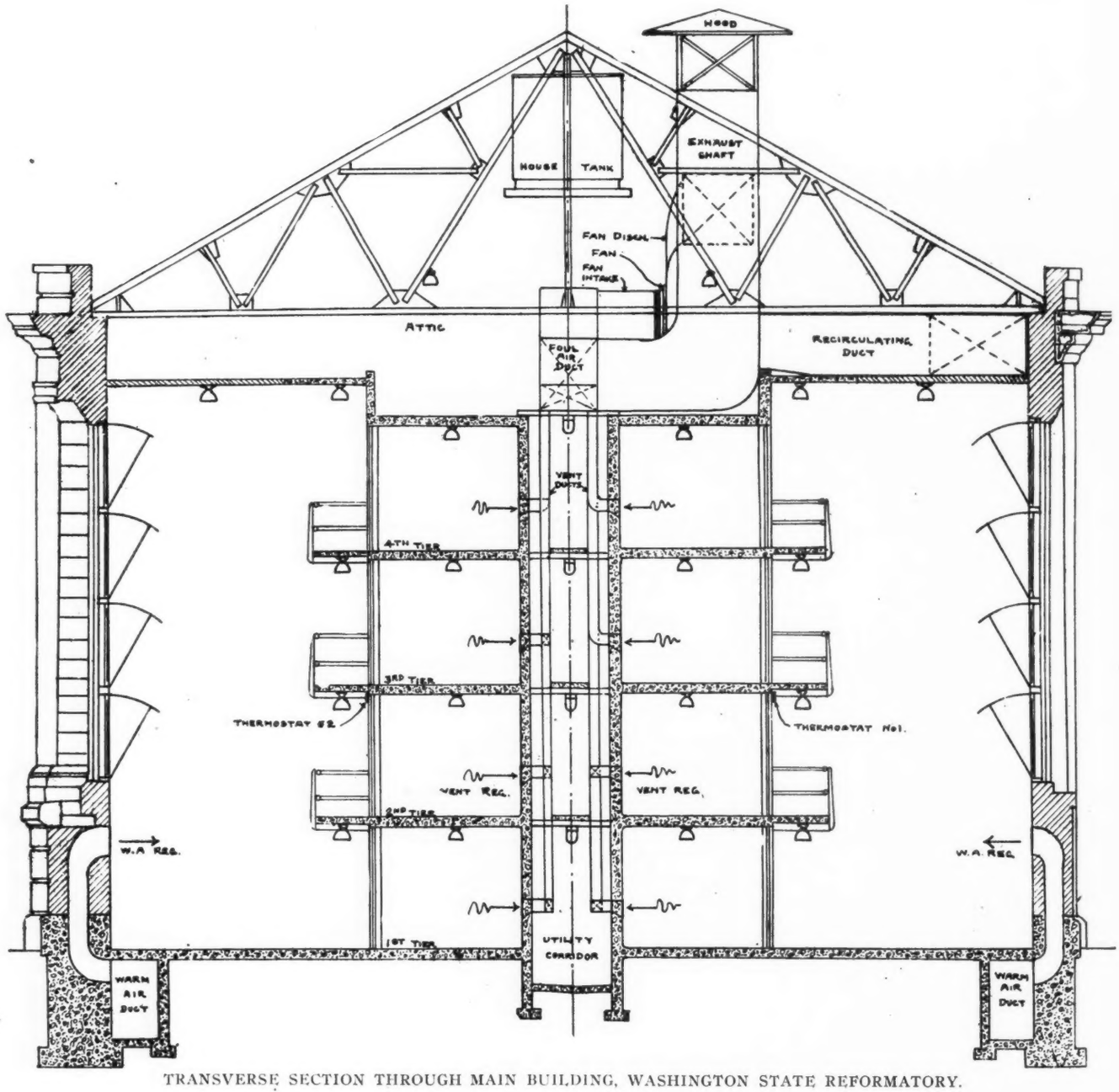
Ventilating Problems in Prison Work

Features of the Mechanical Equipment for the North Wing of the Washington State Reformatory, Monroe, Wash.

THE Washington State Reformatory is located at Monroe, Wash. This institution has for inmates first offenders under the age of thirty years. The usual sentence is from two to fifteen years. Upon good behavior the inmate is pardoned at the end of one year and placed in a position with some employer who periodically reports to the institution regarding his progress and behavior for one year. If all reports are satisfactory, he is entirely released from parole. In case of unsatisfactory behavior while in the institution



BASEMENT PLAN, NORTH WING, WASHINGTON STATE REFORMATORY.



TRANSVERSE SECTION THROUGH MAIN BUILDING, WASHINGTON STATE REFORMATORY.

or on parole, he is subject to the full fifteen years of service.

It is the purpose of the institution to make useful citizens of the boys who are not criminals at heart but who have erred, usually in association with bad company or while under the influence of liquor.

In the accompanying illustrations the plot plan shows the ultimate arrangement of the buildings of the reformatory group. The present buildings include the superintendent's residence, administration building, north wing, educational wing, power plant and one shop, with enclosing wall and guard towers.

All buildings were constructed mainly by inmate labor. The sand and gravel were procured from a gravel pit across the river and the common bricks were made upon the grounds from the clay derived from the building excavations.

ARRANGEMENT OF CELL BUILDING.

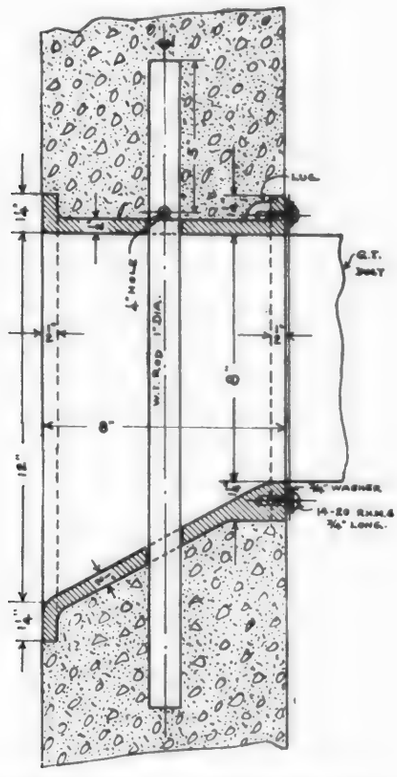
The north wing was the last building erected. It accommodates 320 cells in four tiers. Each tier has four rows of 40 cells, arranged back to back, with a 5-ft. utility corridor between them and balconies in front. The cells are built of reinforced concrete, neatly plastered and finished. Each cell has provision for two cots hinged to the wall. A prison-type water closet and lavatory are located in each cell and the water closet is directly behind the cots to secure some degree of privacy. The lavatory is provided with a combination bibb and drinking fountain spout.

A janitor's closet, with slop sink, is provided on each tier. This room also has a high-pressure steam outlet to permit the use of a high-pressure steam hose and nozzle for spraying the walls of the cells in case vermin should develop therein.

All lighting and the five electrically-operated doors are controlled from the turnkey's cage in the center of the rotunda. Here are also located fire lines and high-pressure steam lines to be used in case of fire or to quell a riot.

STEAM SUPPLIED BY SEPARATE POWER PLANT.

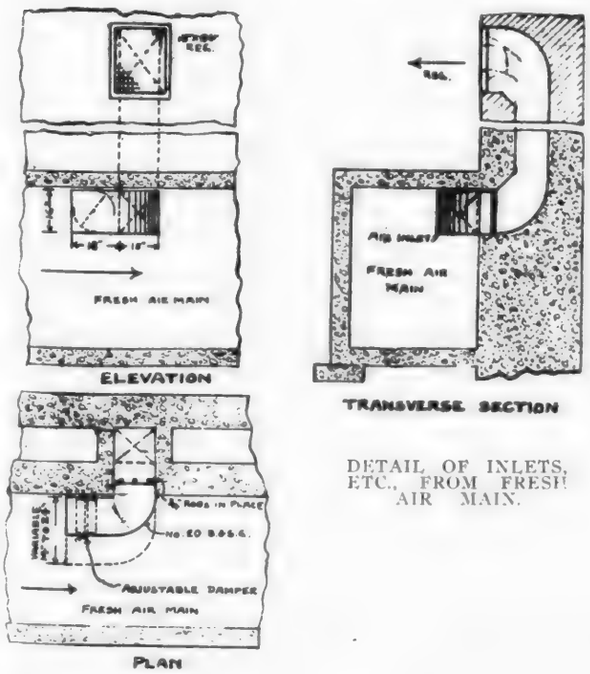
High and low-pressure steam are derived from the power plant through a tunnel. The hot water for the north wing is supplied from a hot water generator and tank in the Administration Building.



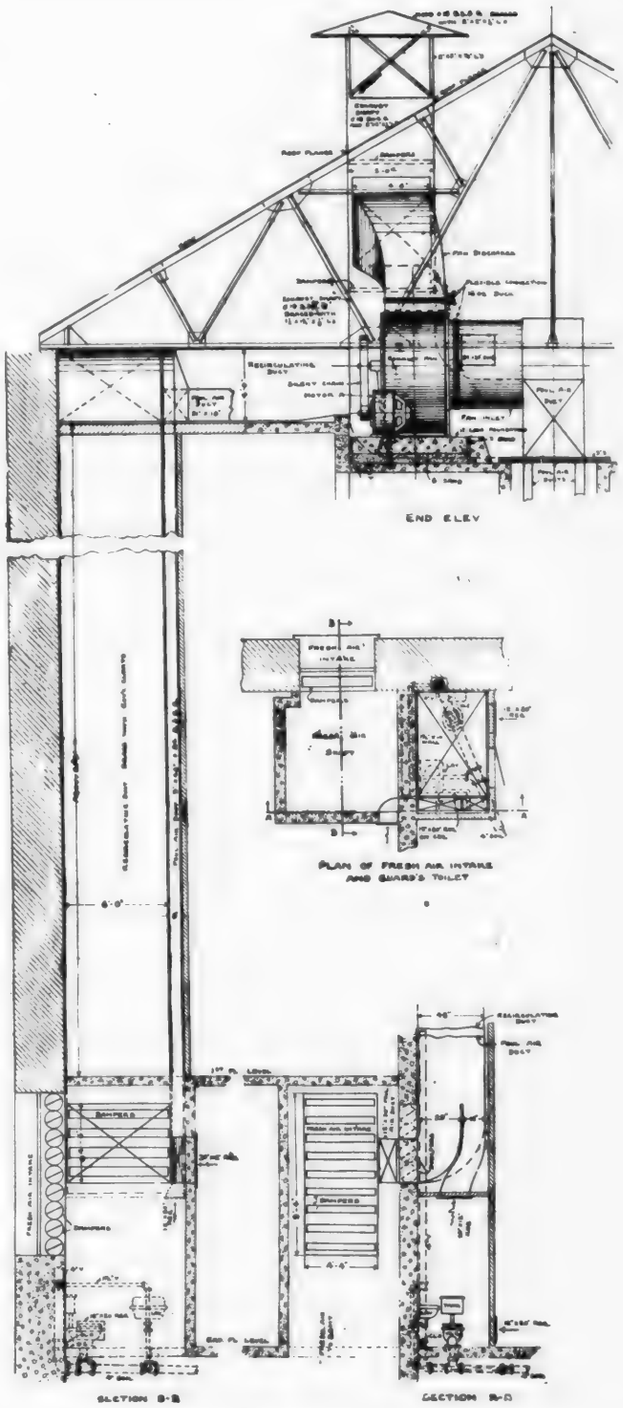
DETAIL OF MAIN FRESH AIR INLET.

EXTENT OF VENTILATING SYSTEM.

Fresh air enters the court through the air intake and passes over the tempering coils, then through the air washer and humidifier to the blower. The blower has a capacity of 30,000 cu. ft. of air per minute against a static pressure of 1¼ in. water gauge. The air then passes over the reheating coils to the two warm-air ducts along the side walls below the floor level from which it passes to the inlet registers, one of which is located under each window. A complete system of temperature and humidity control is provided. The rotunda is heated by direct radiation on a two-pipe vacuum steam system.



DETAIL OF INLETS, ETC., FROM FRESH AIR MAIN.



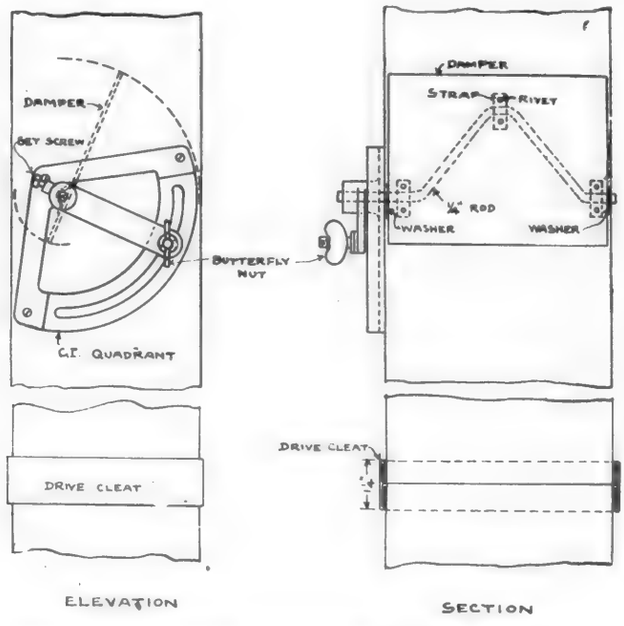
DETAILS OF EXHAUST VENTILATION.

HOW EACH CELL IS VENTILATED.

Each cell has a cast-iron vent outlet affixed with a heavy wrought-iron rod and located directly over the water closet. From each outlet a galvanized-iron duct, with adjustable damper, extends to the main foul air

duct located over the utility corridor. This duct leads to an exhaust shaft passing through the roof of the building. The exhaust fan has a capacity of 25,000 cu. ft. of air per minute and is arranged with a bypass connection between the main exhaust duct and the exhaust shaft. A recirculating duct passes to the fresh air intake.

Remote-controlled dampers are provided in these ducts to permit of operating with or without the exhaust fan or, in case of breakdown of the blower, the exhaust



DETAIL OF DAMPERS AND JOINTS IN VENT DUCTS.

fan may operate the entire system on the recirculating principle.

The entire electrical, mechanical and sanitary systems, with the exception of the sheet-metal work and the thermostatic control, were installed by the inmates who took great pride in doing a "good job" and the installation is mechanically up to a very high standard. Accurate lists of materials were prepared by the engineer for all items purchased on bids by the State. As no excess materials could be used or placed in stock, these lists had to be exceptionally accurate.

Messrs. Saunders and Lawton, of Seattle, are the architects of the building and Erwin L. Weber, of Seattle, the consulting engineer.

Space Requirements For Boilers

Mr. Clute, writing in THE HEATING AND VENTILATING MAGAZINE for November and December, 1922, on the space requirements for mechanical equipment, provides much food for thought on space conservation and the best use of the limited space allotted by the architect for mechanical equipment.

Sometimes the savings made in the economical use of space are greater than that of the cost of equipment proper, especially where real estate is expensive. Thus, the practice of driving boilers at loads considerably higher than the older rating of 10 sq. ft. per B. H. P. results in a saving, not only in the first cost of boilers and boiler accessories, but also in the cost of real estate, foundations, and the buildings which houses them.

As a general rule, floor space is more valuable than head room, as the money value of floor space saved will depend on the cost of real estate, foundations, and buildings; but the money value of head room saved will not be affected by the cost of real estate, and for all practical purposes the cost of foundations. Furthermore, increasing the height of a room does not increase its cost so much in proportion as does an increase in plan area of the building, the reason being that the side walls and columns may be increased at a less cost than the roof construction.

The importance of boiler selection in its relation to the space required may well be considered in a heating plant, as the cost of the building itself is often estimated on the cubic foot basis. Comparison can be limited to the two types of boilers customarily used in heating plants—the cast-iron sectional and the steel firebox types with smokeless down-draft, arranging each for comparison—singly, in battery, or in two units with space between.

For this purpose, space must be left—on one side of a single boiler, between boilers set as two units, on each side of a battery, and at the rear of each boiler. One of the first three locations is required, either for the removal of sections, as with a cast-iron boiler, or the removal of the water-grate bar, as in a steel boiler. As for the space at the rear, this is required with a cast-iron boiler for the proper connection of boiler to flue (together with provision for damper operation), and with a steel boiler for the withdrawal of tubes.

In a cast-iron boiler, the water grate may be removed through the firing doors. Also, sections may be lifted upwards, providing there is sufficient head room and no overhead piping to interfere, a condition seldom found.

In a steel boiler, the tubes cannot be drawn from the front without removing the water grate and brick fire-stop arch, and if this type is selected, it should be brick set, rather than portable, as the latter has a front flue connection necessitating interference with overhead steam piping.

Considering the space requirements of larger installations, mention should also be made of the necessity for leaving doorways or other openings of sufficient size to admit boilers and machinery, or to allow of their removal. This need is obvious, yet often neglected. Likewise, window space or temporarily bricked up openings should be left for the drawing of tubes from boilers, economizers, and heaters.

Head room above the boilers should be sufficient to prevent carrying over of water when sudden demands for steam are placed on the boilers by engines in intermittent operation. Space should also be left at the rear of boilers, as blow-off piping takes up considerable of this space and ample room for access will be found a necessity whenever a tube bursts.

Engines and pumps, set back to back, should have sufficient space between for the removal of cylinders or pump plungers. Finally, ceiling coils should never be used where the head room is limited, as they radiate heat on the heads of those who sit beneath them —T. W. REYNOLDS.

Pipe Welding in Steam Heating Work

By G. B. Nichols

NO TOOL has been devised in recent years that will so revolutionize the steam-fitter's work on large-sized pipe than the oxy-acetylene welding torch and cutting torch. It is now possible to cut pipe to measurements directly in the field and to weld same together, making a joint as strong, if not stronger, than the pipe itself, thereby doing away with troublesome gaskets, flanges and threaded couplings and making it possible to install continuous pipe covering.

Recently Cornell University has installed miles of underground pipe, varying from 1½ in. to 12 in. in diameter for distributing mains from its new central heating plant to the various buildings on the campus; all of this pipe was acetylene-welded and consisted of standard-weight steel pipe.

The steam lines will be run at 200 lbs. steam pressure. The pipes were installed in underground split-tile conduit construction of the Johns-Manville Company's manufacture and were lowered into the trench in 40-ft. lengths. The lowering and placing of pipe in the trench can easily be done by unskilled common labor, although there is a feeling among the steam-fitters that this ought to be done by them. This, however, is a point for some discussion.

METHOD OF LOWERING PIPE INTO TRENCH

To lower a pipe into the trench the best method is by placing a wood tripod consisting of three wood uprights of 6x6 in. joist bolted together at top with light chain hoist suspended from top. The pipe is first rolled over the trench on wood crosspieces; then the tripods are placed over same at each end, when pipe is then picked up by falls and lowered into place; on smaller sizes the chain falls can be replaced by rope tackle.

In the purchase of pipe for welding, sizes below 4 in. should have straight-end; above 4 in. however, the pipe should be given a slight bevelled end of thirty degrees. This can be done at the mill with a special cutting-off tool.

ACETYLENE WELDING VS. ELECTRIC WELDING

Acetylene welding for general use is preferable to electric welding as it is more convenient and may be done better in the open. The tanks of acetylene and oxygen should be mounted on a wheel truck with large wheels so that same can be easily moved along the trench in underground construction. The welders generally work in "gangs," a gang consisting of a welder and his helper, and on a large job the schedule of wages should be the same as for steam-fitters in the same district.

Each welding gang should be furnished with the following tools:

FIG. 1—PIPE ON SIDE HILL IN CONDUIT READY FOR WELDING.

Portable gas truck.
Oxygen and acetylene gas.
Oxygen and acetylene gauges.
Tubing in 50-ft. lengths.
A cutting torch and welding torch with assortment of tips.
Chain tongs for turning pipe.
Welding rods.

In the purchase of welding rods, the ¼-in. diameter size furnished by all of the welding companies is preferable for pipe welding from 3 to 12 in. size, as the minimum amount of gas will be used for this size of rod.

CAPACITY OF WELDING GAUGE

In general a welding gang will weld in ditch work, also line up pipe, the following number of joints per day:

Standard Weight Pipe Inches Diam.	Joints
12	6
10	6
8	7
6	7
5	8
4	9
3	9
2	10

When a welding gang is working on the larger size of pipe, say from 6 to 12-in. each gang will require one

tank of acetylene and one tank of oxygen per day; on the smaller sizes, however, a similar amount will last about one and a half days. In general, working day in and day out on a job, a welder will use up about 3 lbs. of welding rod per day, but of course this varies with the size of pipes used.

In welding pipe in ditches, it is preferable, if possible to lower the pipe directly into the ditch onto roller pipe supports and to weld in the bottom of the ditch rather than to weld same on the ground and then lower. This, of course, applies only to steam conduit systems. The welding in general is done on the top of the pipe, the helper turning as same is welded.

Taking all items of cost together, such as gas, labor and welding material, the cost will amount to approximately seventy-five cents per inch of diameter. In other

FIG. 2—PIPE BEING WELDED, WITH HELPER TURNING PIPE TO KEEP POINT OF WELD AT TOP.

words, a 10-in. pipe should be welded for $7.50. This price will also include the lining-up of the pipe.

CONVENIENCE OF WELDING IN MAKING FITTINGS

In the matter of fittings, it is possible to make elbows by mitering the pipe and welding together for any angles. It is also of great advantage in connecting a new line to an existing line, the new line simply being welded in at the point of connection, and no disturbance to the present line will have to be made. In one case of this kind, a 6-in. pipe was welded into an existing vertical steam-line, the whole connection operation taking less than two hours and the service simply being cut off for this period. Also in the matter of repair, when a steam line shows a leak, it is possible to simply cut off a short section with a cutting-off torch and to weld in a new section.

In the cutting off of pipe with the cutting torch, it is surprising how little time this takes. It has been demonstrated that a 12-in. pipe can be cut in less than two minutes and that the cut will have clean edges and be ready for welding.

The writer believes that in the very near future all steam fitting establishments will be equipped with welding outfits and that a first-class welder will be in their employ.

HOW WELDING LENGTHENS LIFE OF PIPE

In underground distribution systems, the life of the system is determined by the corrosive action of the return water. In general, returns last about twenty-five years, although return pipes have been known to last much longer. With screw and coupling pipe, the threads at the couplings cut through approximately one-half of the thickness and there are always a few threads extending beyond the coupling. In observing the deterioration of the return pipes it is generally found that they pit through at these exposed threads and it is reasonable to assume that the threads cutting away one-half of the thickness of the material simply reduce the life of the pipe by 50%. In other words, if there were no threads, it is conceivable that pipe might last fifty years.

In the welding of pipe the joint is thicker than any other portion of the pipe. It is therefore conceivable that welded pipe will have twice the life of threaded and coupled pipe. This, I believe, is a point of great merit in the selection of a welded system. There is also less chance of the pipe giving away at the joints with a welded system due to expansion strains.

In the selection of pipe, either wrought-iron or steel can be welded. Steel pipe, aside from price, however, has some advantage for underground work in that it is manufactured in 40-ft. lengths, thereby reducing the number of joints to be made. The question, however, of wrought-iron against steel pipe is one that each engineer must determine for himself. It is unfortunate, however, that the wrought-iron manufacturers do not manufacture pipe in 40-ft. lengths. The present length is somewhat of a detriment to the use of their product.

Ventilation Fundamentals

"1. There are no deleterious organic substances in the air expired by normal persons.

"2. Carbon dioxide from the exhalations of occupants of a room practically never occurs in sufficient amounts to be harmful.

"3. The important factor in ventilation is the maintenance of *thermic* conditions of the air that will take care of the heat given off by the human body without the undue exercise of the heat-regulating mechanism.

"4. A sufficient quantity of air must be supplied to maintain the oxygen content necessary for breathing purposes and to carry away excessive heat and moisture.

"5. Air for ventilation purposes must be practically free from dust, bacteria, and other injurious substances."

E. VERNON HILL *before the American Society of Heating and Ventilating Engineers.*

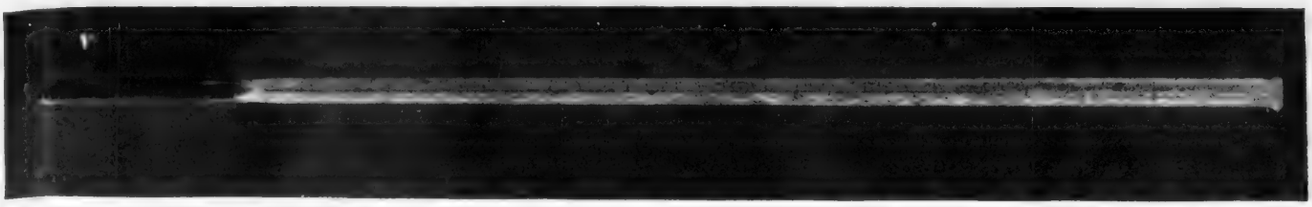


FIG. 7—ROOM TESTING THERMOMETER, SCALE 50° TO 80° F. GRADUATED IN 0.2°

Aerology for Amateurs and Others

The Evolution of Modern Ventilation and its Effect on Present and Future Practice

By E. Vernon Hill.

III—The Manufacture and Use of Thermometers.

THE total heat of the air is made up of sensible and latent heat. The degree of sensible heat is measured by the ordinary dry-bulb thermometer. The latent heat is determined by finding the wet-bulb temperature with a wet-bulb thermometer, or by finding the dew point with a dew-point instrument and determining the latent heat by complicated mathematical calculations or referring to a psychrometric chart.

THE DRY-BULB TEMPERATURE

The best instrument for determining the dry-bulb temperature is the mercury thermometer. Mercury thermometers mounted on metal or wood backs should not be used as the thermometer is liable to slip on the scale and the readings be inaccurate. The graduations should be engraved on the stem.

For taking room temperatures, a thermometer of less than 5 in. long should not be used as the graduations are too close for accurate reading. The stem should be graduated for at least every 2° and degree graduations are preferable. Thermometers of this kind usually have a range from—10° or — 20° to 120°F. If more accurate readings are desired, special thermometers may be procured graduated from 50° to 80°, and in fifths or tenths of a degree.

A short description of how these thermometers are manufactured and calibrated may not be out of place as it shows the user why he pays many times the amount for one instrument that he might pay for another which appears to be practically identical. It also illustrates certain points in the use and care of thermometers.

In making thermometers, the instrument maker selects a piece of tubing, manufactured for thermometer purposes, somewhat longer than the instrument will be when it is finished. The tubing is open at both ends.

The first operation is making the mercury bulb. This is blown from a separate piece of thin walled tubing; the bulbs are blown in pairs and cut apart, one being shown in Fig. 8 (A). The bulb is next joined to the thermometer in the blow torch flame, the long extension melted off and the end rounded as it appears in "B." Next, a larger bulb is blown from separate tubing, called the funnel. This is attached to the upper end of the tubing, as shown in "B."' It is doubtless named the funnel as it is used for filling the instrument with mercury. After the funnel is sealed to the upper end of the thermometer, this bulb and also the mercury bulb are heated in the flame to as high a temperature as is possible without melting the glass and the long extension to the funnel immediately sealed in the flame.

The instrument is now allowed to cool. The intense heat to which the bulb was subjected creates in it a partial vacuum. After the instrument is cooled, the extension to the funnel is plunged underneath the surface of a cup of mercury and the tip broken off. The partial vacuum in the instrument causes the mercury to rush into the funnel, about half filling the same.

The instrument is now held in an upright position and by alternately heating and cooling the bulb, the mercury finally fills the same and the stem. The funnel is now melted down until it becomes almost a solid mass, thus expelling all air, leaving only mercury in the instrument. It is then sealed and a small particle of mercury from the stem is jarred into the molten mass of what was originally the funnel. The mercury immediately vaporizes and again expands the funnel, as shown in "C."

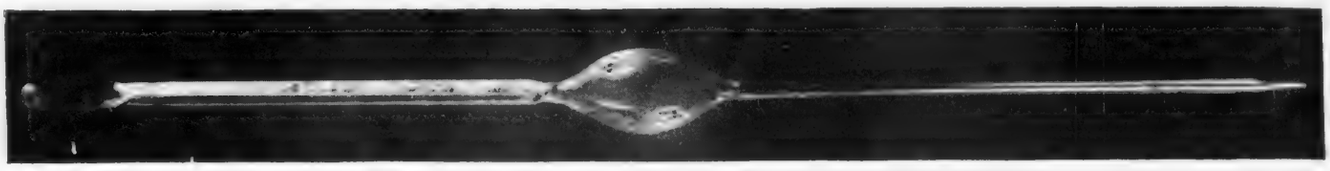
We now have the instrument filled with mercury with a bulb at the top containing only mercury vapor. As the bulb cools the mercury vapor condenses and a practically perfect vacuum results. The heighth of the column of mercury in the stem is next adjusted by shaking portions out into the bulb at the top until approximately the right amount for the scale to be used remains in the instrument. It is then sealed off at the proper length, somewhere near the top of the stem.

HOW A THERMOMETER IS CALIBRATED

The most important part of the operation still remains, viz., calibration. The instrument is now placed in a bath of finely chopped ice and water and allowed to stand until the mercury comes to rest. This is 32°F. and this point is carefully marked on the stem. If the instrument is of sufficient range, it is next placed in boiling water and the boiling point marked. If it is a 120° F. thermometer it is placed in warm water with a calibrated instrument certified to by the Bureau of Standards and one or more points marked at the upper

part of the scale. It then goes to the engraving machine where the stem is marked off in equal degrees between the points etched on the stem. Finally, after the etching is completed, high-grade thermometers are tested for every 20° interval and a curve plotted showing all variations if such exist, due to slight variations in the bore of the glass.

A—THERMOMETER BULB.



B—BULB AND FUNNEL ATTACHED.

FIG. 8—THERMOMETERS IN PROCESS OF MANUFACTURE.

In the cheaper thermometers all calibrations previously described are omitted and this labor saved. The instrument is completed and sealed and placed with perhaps thousands of others in a room where the temperature is maintained at 70°. Scales are stamped, or etched, on metal or wood, having a range as close as can be approximated for the instruments. The thermometer itself is then placed on the scale with the mercury column on the 70° mark. The instrument, therefore, is fairly accurate at 70° but above or below this point it is in question.

In thermometers containing no air or other gases, the mercury column is easily broken and it is also easily reunited by vigorous shaking. Some instruments are filled with nitrogen gas above the mercury column. This prevents, to a certain extent, the separation of the mercury column, but it also makes it difficult to reunite the mercury column if it becomes separated. The most satisfactory method is to provide a small expansion bulb at the upper end of the thermometer where the mercury can be driven by heat above the point of separation. On cooling, the mercury flows back into the stem with the column reunited.

Properly-made and calibrated mercury thermometers are without question the best instruments for determining air temperatures, as the user can feel sure that if properly used he will always get the correct reading.

PRECAUTIONS IN TAKING READINGS

In taking temperatures of the air, certain precautions should be observed:

1. The instrument should always be held by the top of the stem and the hands should not be brought into contact with the bulb during the time observations are being made.

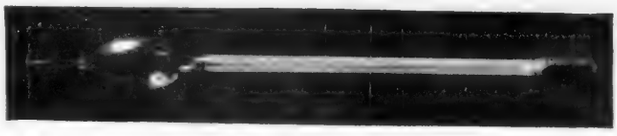
2. The instrument should be held at least 2 ft. from the body, as bodily heat affects the reading.

3. It should not be held close to windows or other openings or to radiators or other sources of heat. It should in no instance be suspended against the wall.

It is sometimes desirable, when taking accurate readings, to protect the bulb against the effect of radiant heat. For this purpose the bulb should be suspended in a paper or cardboard tube by means of thread attached to the tube to the stem of the thermometer.

In taking the temperature of walls or window glass, the bulb may be held in contact by means of a gummed label. This gives a close approximation, although not an extremely accurate result. The procedure, however, is often of value and sometimes explains peculiar phenomena.

I recall an instance in a test in the University of Chicago where the stenographer continually complained of being cold, although the temperature of the room was 70° and the relative humidity 40%. She was located, however, close to an outside wall of stone, which had a very low surface temperature in cold weather and the radiant heat loss evidently accounted for her discomfort. A screen between herself and the wall corrected the difficulty.



C—FUNNEL EXPANDED BY MERCURY VAPOR.

(To Be Continued)

Heating and Ventilating Needs of Modern Ocean Liners

IN the last twenty years or so the large steamship companies have indicated a most progressive spirit in their efforts to improve the amenities of ocean travel. Not only have ships increased in size and speed, but the introduction of improved means of propulsion has permitted the allocation of larger spaces for the accommodation of passengers, and has facilitated the introduction of light and air to the various parts of the interior which, a few years ago, would have been considered impractical.

Many of our first-class ships will compare most favorably as regards interior decoration with the finest buildings, and, in fact, almost everything that can be done is done to make the passenger forget that he or she is at sea.

It has to be admitted, however, that the methods of heating and ventilation, with few exceptions, have not progressed at the same rate as the other great improvements.

In considering the necessities of air supply to such large numbers of people, the various conditions which may prevail at different times have to be taken into account. Those ships plying across the North Atlantic between Europe and America have to cope with the heat of the American summer and the intense cold of the North Atlantic winter, where zero temperature Fahren-

heit is occasionally met with. Frequently during a single voyage considerable variations of temperature take place, the transition from one to the other being extremely rapid.

Much time and thought, as well as money, have been spent on producing beautiful embellishments, and as we all know that the directors of the large steamship companies are astute business men, it may be taken for granted that they would not go to so much trouble and expense unless they were thoroughly satisfied that tasteful decoration and treatment would increase the earning power of their boats.

SPACE FOR VENTILATING DUCTS NECESSARILY CURTAILED

When designing an important building, the architect consults the heating and ventilating engineer at the commencement of the designs and embodies therein space for the accommodation of the plant and ways for ducts, pipes, etc., as well as the approximate positions of his ventilating inlets and extracts.

The naval architect is confronted with a similar problem, though probably of a much more complicated nature. The spaces that may be allotted to various services are much more restricted, and, in addition, there are the requirements of the various Governments and shipping authorities that have to be met. In practice, unfortunately, one finds that the actual working of the scheme, more often than not, is left to the shipbuilder to develop, more or less, as the work proceeds.

As every inch of the available space is claimed either for the electrician, plumber, automatic door operating gears, fire hydrants, etc., and the numerous other devices which are vitally necessary, the path of least resistance is usually taken, and the ventilating ducts are curtailed.

For convenience in passing through the restricted spaces, if for no other reason, the duct manufacturer will curtail his work to the least possible area, leading to high-water gauges and high-power expenditure for operating the fans.

Furthermore, the high air speeds usually entail a high speed of emission through the inlet to the cabins or spaces, causing unnecessary drafts which would not be endured in other circumstances, and frequently, to pacify the passengers, the ventilating system to some parts has to be run at reduced speed, therefore the full benefit of the plant on which so much money has been expended, is not obtained.

MR. STEWART AND THE THERMO-TANK

The pioneer of the application of combined heating and ventilating systems to ships is Mr. A. Stewart, of Glasgow, the inventor of the Thermo-tank, the introduction of which was an epoch-making event in marine history. This apparatus consists, briefly, of a steam heater in conjunction with a fan, mounted on a hollow base, from which trunks are led to various parts of the ship. By an ingenious arangement of valves, air from the fan may be blown direct from the base, or a position may be by-passed through the heater, mixing with the cold air in the base, the proportions being varied according to the temperature required. Or, alternately, the fan may be arranged to exhaust from the base and discharge to the open air, the trunks thus becoming extract instead of inlet. This latter arrangement is a Board of Trade requirement for all apparatus used for ventilating third-class and crew spaces.

Devices for humidifying the air by steam or water sprays are frequently fitted.

THE OMISSION OF EXHAUST APPARATUS

Probably it is due to the efficiency of these various apparatus that there is a serious tendency on the part of those responsible for the design of the installation to neglect the provision of adequate means of exhausting vitiated air. Unquestionably, this neglect is the principal cause of the oppressive atmosphere which so frequently exists on passenger ships at sea, particularly in bad weather, when portholes and other means of natural ventilation necessarily must be closed. The large volumes of air introduced by the supply of fans must, of course, find an outlet somewhere, but it does not follow that the fresh incoming air displaces the vitiated atmosphere.

If the occupants are deprived of the comfort of adequate supplies of fresh air at a suitable temperature, there is a natural disinclinaiton to appreciate their luxurious surroundings. The space available for each person is necessarily limited, hence the further necessity of a frequent air change. This, however, is rendered more difficult, owing to th restrictions of space, and considerable skill and ingenuity are required to permit the ingress and egress of sufficient air volume without causing intolerable drafts,

Public rooms, such as dining-saloons, lounges, smoking-rooms, drawing-rooms, etc., on the large passenger ships are usually dealt with, as regards warming and ventilation, in the same manner as similar rooms ashore. The exposed parts are usually warmed by radiators, and the ventilation is accomplished by special ventilating units, the number usually allocated to each room varying according to the size and the owners' views as to the number of air changes required.

Extracts are taken from convenient positions, and from the galleys in the case of dining saloons; but it is generally found that, as in the accommodation, the mechanical extraction provided is relatively small as compared with land practice.

The heating and ventilating engineer is continually meeting and overcoming difficulties. His method of dealing with the problems in question will be first to balance his losses through exposure by direct heating, convected heaters being employed in drafty situations, such as entrances, etc.; but in limited spaces radiant heat will be preferred, the use and knowledge of which is increasing daily. This method may be applied electrically on ships which are not sailing in the coldest regions.

Having provided for the direct heat losses, the air supplied need be warmed to such temperature only as will maintain comfortable conditions in the public rooms or cabins, and where differential temperatures are required from the same unit of supply, cold air by-pass arrangements and mixing chambers would be employed.

Ample exhaust systems to remove vitiated air and heat from around engine casings, etc., are essential, and these must be arranged so that vitiated air will, in no circumstances, be drawn into the accommodation.

J. T. MUSGRAVE, *before Institution of Heating and Ventilating Engineers*

Methods of Supporting and Erecting Ducts

By T. W. Reynolds.

TOO much care cannot be taken to obtain the best method of erecting and supporting the ducts and flues in heating and ventilating installations, as the satisfactory operation of the system depends to a considerable extent upon the strength of the ducts and the permanency of their supports. Owing to the small scale upon which most of the layouts are made and the general lack of detail drawings, much is left to the workman's own judgment, so that workmen inexperienced in work of this nature, are quite apt to spoil the effectiveness of a well-designed system by lack of attention to details. Thus, the sorriest looking parts of the average sheet metal job are more often the supports.

HEAVIER GAUGES AND SUPPORTS PREVENT BUCKLING AND SAGGING.

The method used for bracing and supporting a duct depends not only upon its size and width, but also upon the amount of rigidity obtained by the method of joining the sheets and the gauge of the metal composing the duct itself. The metal should be of a gauge (or stoutness) commensurate with the size of the duct and the work required, and in all respects suitable for the materials to be transferred; lightest and thinnest for the mere passage of air; heavier and stouter in dust-collecting systems; and especially strong for hot and acid fumes, metallic particles and the like.

Ducts should be made of heavier gauge metal and otherwise protected wherever liable to mechanical injury or the passage of workmen of other trades, as buckling affects the tightness of the joints and decreases the area of the ducts. Therefore, all large horizontal ducts (especially those in the attic space) should be made sufficiently strong to prevent buckling in any part, even when supporting the weight of a man on temporary planking reaching from hanger to hanger. This will permit also of a man passing along for cleaning.

Although cylindrical ducts are generally the strongest and most effective, most economical in area and thickness of metal and easiest to clean, square ducts, or those of rectangular section, are the form most frequently used, in particular where space is at a premium. In common practice, the same gauge is used as with round ducts having an equivalent area, and in large sizes laid horizontally, the sides are reinforced with external stays to increase their strength and prevent collapse. This is better than increasing the gauge or thickness of the metal, though even with heavy gauges, under certain conditions, bracing is necessary to prevent the top and bottom from sagging.

VARIOUS METHODS OF SUPPORTING DUCTS.

As each building offers its own peculiarities in the supporting of ducts, the illustrations shown herein are typical for usual conditions only. Sketches have been arranged accordingly, and grouped; first, according to the kind of floor construction, as tile, wood, concrete, or steel, and secondly, according to the running of the ducts, i. e., either transversely or parallel with the beams.

Hangers should be spaced according to local conditions, never over 6 or 8 ft. apart (the usual length of the sheets), and closer where ducts are insulated, or finished with lath and plaster, as in exposed rooms. In the latter case, the method shown at J is used, though varied slightly for fireproof construction by using angle irons covered with wire mesh and plaster.

If the floor construction is of concrete enclosing steel beams, and an angle-iron frame is used inside of the duct, then large bolts or rods (placed in holes drilled through the floor) are attached to the angle irons, as shown at M, large washers being used at each end of the bolts. Sometimes the rods are carried through the floors, anchored at the upper end, and provided with long thread and nut at the lower end. This permits leveling of the ducts.

Quite often the ducts do not line up with the sides of the beams, or again, the width of the duct may bring one of its sides considerably off center in relation to one or more of the beams. In the latter case, the method shown at N is the best, as angle irons are stiffer than flats, but if flats are used, they should be turned on edge in order to obtain maximum strength of the material.

KIND OF MATERIAL USED FOR SUPPORTS.

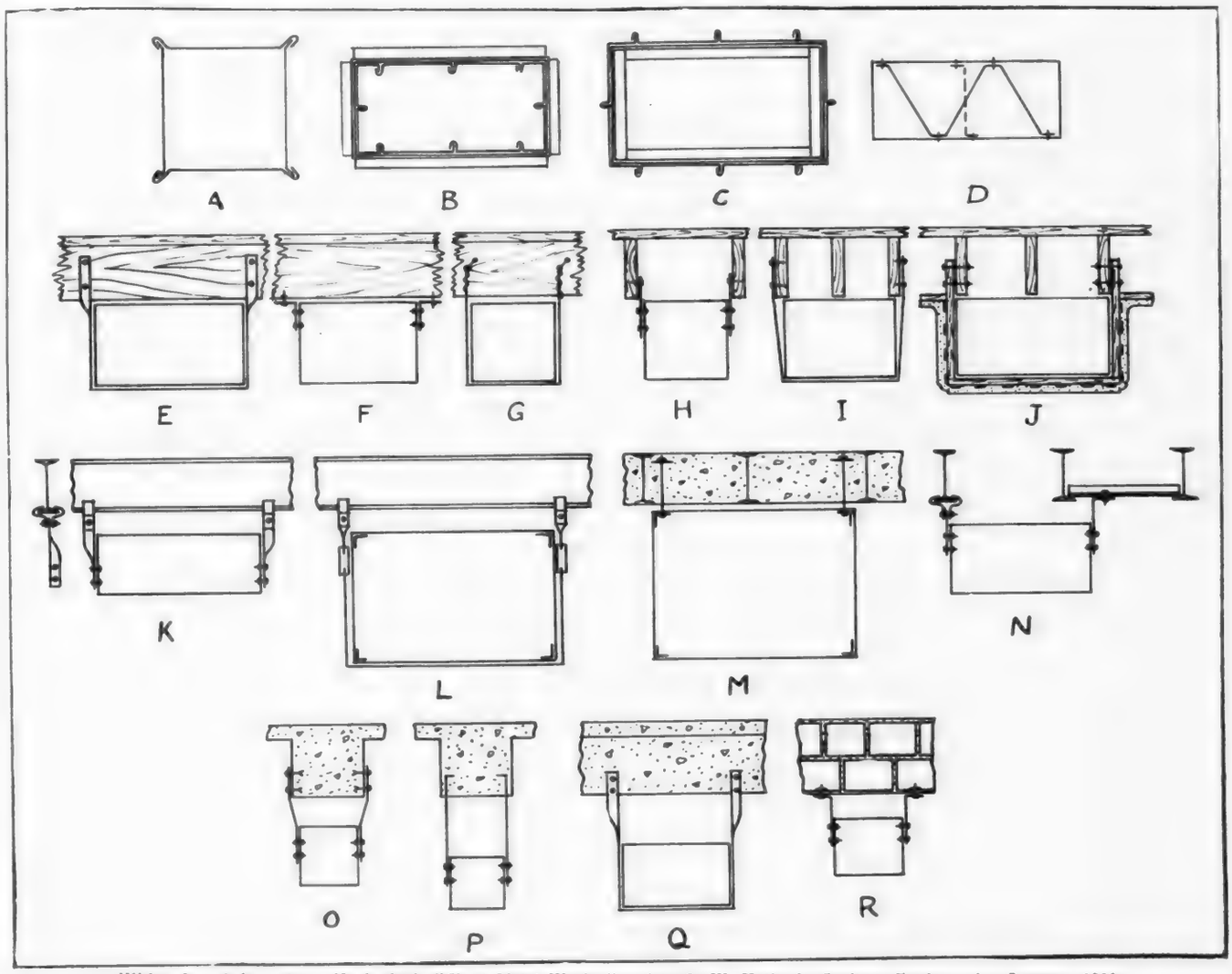
Various materials (either black or galvanized) are used for bracing and supporting ducts,—iron rod for heavy round ducts, tinned or galvanized wire for small ducts, and band and angle irons for braces and hangers, the band iron or steel being made soft as to allow bending withou heating. Turnbuckles are also used (see L), thus allowing the large and heavier ducts to be readily raised and lowered, or pitched for inclination of run.

Usually, flat-head tinned iron rivets are used for riveted metal, and ¼ in. × ¾ in. round head stove bolts for bolting angles and braces together, washers being also used so as to give a flat bearing against the sheet metal, thus preventing the bolts or rivets from tearing through the sheets.

HOW THE DUCTS ARE BRACED

Angle iron is used for stiffeners around large size ducts to keep the middle of the duct from sagging Thus, wide ducts, or square or rectangular ducts of more than 16 sq. ft. area, should be built on and properly riveted to 2-1¼ in. or 1 ½ in. × ⅛ in. soft steel angles, spaced not over 4 ft. apart, but for smaller work and spans under 4 ft., the use of angle iron is unnecessary. In such cases, the standing seam gives all the stiffness required, in particular on square ducts where this form of seam strengthens the entire run as shown at A.

Ducts of small size, not requiring angle iron bracing,



With acknowledgments to Neubecker's "Sheet Metal Worker" and to O. W. Kothe in Sanitary Engineer for January, 1923.

TYPICAL METHODS OF SUPPORTING DUCTS.

are often braced as shown at D, still smaller ducts being braced as shown dotted, but such braces, if used at all, should be turned as shown, so as to offer least resistance to the passage of air.

Very wide ducts are often braced, both longitudinally by standing seams, and transversely by angle irons, as shown at B. The standing seams are then placed inside of the duct, but if placed outside, as is sometimes desired for application of covering (as at C), some allowance should be made for the decreased area caused by the interior angle-iron bracing.

SOME THINGS WHICH SHOULD NOT BE DONE.

There are many things in connection with sheet metal work which should not be done. For example, it is poor practice, though almost common practice, to construct the short vertical sides of main trunk ducts with metal of a lighter gauge than that forming the top and bottom thereof, but the feasibility of this construction depends somewhat upon the method of supporting the ducts, whether hung by metal strips attached directly to the upper sheet, or by supports carried under and around the sides of the ducts.

Other faults are the construction of vertical ducts or flues with single thickness partitions between ducts, and the supporting of a duct, where run below one of greater width, by hanging the lower one from the sides of the upper. Again, the driving of wood plugs into masonry, or nails, wires and cotter pins in the ducts, should not be allowed, nor the punching of holes in any way in the ducts to aid in their erection.

The Cost of Heating a Home

It is estimated by one authority (Chapman) that the coal burned per year for domestic purposes in the United States is about 80,000,000 tons. Another (Prentice) estimates it as 1.1 tons per capita, or about 110,000,000 tons annually. Taking the lower figure and assuming that the average price in the cellar is $10.00 per ton, we arrive at an annual coal bill for domestic uses of $800,000,000. Taking the other figure of 1.1 tons per capita and a family of four, at $10.00 per ton we have $44.00 per year for each family.

The first cost of the fuel does not, however, constitute the whole expense. Some times not even the greatest expense. The monetary damage to interior furnishings, decorations and clothing caused by smoke and soot many even exceed the first cost of the fuel, to say nothing of the effect on exteriors. The expense for ash removal is probably the least, but it is there and moreover it is a dirty job.

R. R. Jones *before Akron (O.) Engineering Society.*

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ENGINEERS who practise in New York State and who do not secure their licenses under the new "Engineers' License" law before May 5 next are going to find themselves in a fine young "jam," according to the plain wording and intent of the law. How serious the situation is may be gauged from the report of Colonel Barbour, chairman of the licensing board, who is authority for the statement that up to date fewer than 2000 applications have been received, while the estimated number of engineers in New York State is between 10,000 and 15,000.

Whatever one may think of the law, it is one that has "teeth" in it and is not to be brushed aside as a mere formality. This has already been tried by those who have casually stated their qualifications as so many years with this or that concern and who have been brought up with a round turn, with instructions to be more explicit. Nor can politics be expected to have any influence in making the way easier. The licensing board is made up of men of recognized engineering standing who are applying the law in the way it was intended. They recognize the fact that they are dealing with precedents and naturally are feeling their way, but it is perfectly safe to say that those who are granted licenses will be worthy of them.

A CLOSE study of the law bears out the estimate of its importance expressed in these columns just a year ago. "In order to safeguard life, health and property," it reads, "any person practising or offering to practise professional engineering . . . in the State shall hereafter be required to submit evidence that he or she is qualified so to practise, and shall be licensed as hereafter provided, and . . . it shall be unlawful for any person to practise professional engineeering. . . . in this State unless such person has been duly licensed under the provisions of this act." Just what is going to happen on May 5 next, when the law becomes operative, is hard to conjecture. "Any person," the law continues, "who after this act has been put in effect two years (it became a law May 5, 1921) is not legally authorized to practise professional engineering . . . in this State . . . shall be deemed guilty of a misdemeanor and shall for each offense of which he is convicted be punished by a fine of not less than $100.00 nor more than $500.00, or by imprisonment for three months, or by both fine and imprisonment."

To carry out the provisions of the law, a State licensing board of five is organized. This board meets several times a month in Albany and goes over the applications. At the present time there are less than 500 applications awaiting action and as this is being written there remain but sixty days in which to license the remaining 8,000 or 10,000 engineers in the State. It is already too late to avoid a congestion that will simply overwhelm the machinery of the board.

One clause of the law which has misled many into thinking that its provisions were more limited than they are refers to the requirements for doing public work. "No county, town or village or other political subdivision," reads this clause, "shall engage in the construction or maintenance of any public work involving professional engineering . . . for which plans, specifications and estimates have not been made by, and the construction and maintenance supervised by, a licensed professional engineer," although this only applies to projects involving more than $2,000. It will be noted, however, that this does not mean that unlicensed engineers can do other work involving engineering.

WHILE the qualifications are fairly rigid, they will not be found unduly onerous. No one is eligible who is under 21 years old and who has not been actively engaged for four or more years in the practice of professional engineering, but two years of study in a school of engineering will be considered as equivalent to one year of active practice. Those who have had six or more years of active practice, one of which shall have been in responsible charge of work, will be considered to have adequate prima facia qualifications, as will graduates of a course of not less than four years in engineering, who have had an additional four years of active practice, one of which shall have been in responsible charge of work. The license fee is $25.00.

If your business is in New York State and you have not already secured your license, there is no time to be lost. Application forms may be procured in New York City from the Board of Licensing for Professional Engineers and Land Surveyors, at 29 West 39th Street, and should be forwarded without delay to Herbert J. Hamilton, assistant in charge of professional examinations, State Education Building, Albany, N. Y.

SERVICE DEPARTMENT

An Unusual Steam Consumption Formula

QUESTION: At a certain large railroad terminal there are several lines of railroads entering the terminal. The Pullman cars when standing in the terminal are heated by steam furnished by the Terminal Company. Each road is charged so much per day per car.

The point at issue is the method used by the Terminal Company in arriving at the amount of steam used for heating cars and for other purposes. The Terminal Company determines the amount of steam used for heating buildings by the following formula:

$$\text{Pounds of steam} = \frac{\text{Cu. Ft. Contents} \times 3 \times (T - t') \times 24 \text{ hrs.} \times \text{days}}{53.9 \times 963}$$

T = outdoor temperature, deg. F.
t' = 70° F.
53.9 = reciprocal of specific heat of air.
963 = B. T. U. per pound of steam.

It is with regard to this formula that I would like your comments, that is, whether you have ever seen this or a similar formula. They charge the pumps that pump water with 290 lbs. of steam per 1,000 cu. ft. of water pumped, the amount of water pumped being determined by meter. They add together the amount of steam used for buildings and the amount for pumping water and charge the balance to the heating of cars. It strikes me that there are too many loose ends in this method and too many chances of variation and error. I do not know exactly their method of determining the total amount of steam generated, but presume they have flow meters.

The Terminal Building is heated by a fan system and they evidently figure on a 20-min. air change.

ANSWER: Not being in full possession of the facts, it is hardly fair to criticise the formula, though it does seem as arranged to mean nothing. Thus, if T becomes zero, we have 0 — 70°, an error which speaks for itself. Furthermore, T should be the temperature of the air as delivered from the fan blast heaters to the system of ducts, and t_1 the temperature of the outdoor air (if recirculation is not used).

This will be apparent if the total heat added to the air is thought of as being divided into two parts: (a) *that which would be added were ventilation only being considered, and (b) the additional amount to supply the heat lost through walls, expressed in the form

$$H_1 = Q\,D\,C\,(t_2 - t_1) + H_2 = Q\,D\,C\,(t_3 - t_2)$$

in which H_1 = heat in B. T. U. per hour added to the air required for ventilation, and H_2 the heat added to the heating medium (air) in order to make up for the heat loss through exposed surfaces.

Q = quantity of air to be introduced per hour for ventilation, or for heating requirements, as the case may be.

D = density of air at temperature t_2 in pounds per cubic foot.

$t_1\ t_2\ t_3$ = temperatures of air, outdoors, in rooms, and of air delivered to the rooms, in the order given.

C = specific heat of air,—as determined by Carrier, this is 0.2415 B. T. U. for air at constant pressure as used in ventilating work.

D = (0.07495 at t_2). This multiplied by C, = 0.0181, the B. T. U. absorbed by 1 cu. ft. of air per degree, the reciprocal of which is 55.25, instead of 53.9. The latter is the cubic feet of air warmed 1° per B. T. U., and is not the reciprocal of the specific heat of air, as stated in the formula submitted.

Now, consider a building ventilated with three air changes, or a total of 300,000 cu. ft. per hour. Assume a fan system supplying heat losses as well as ventilation requirements, and let 80,091 B. T. U. be the heat loss through exposed surfaces when t_2 is 70° and t_1 zero, t_3 also 70°, then

$H_1 = (300{,}000 \times 70) \div 55.25 = 380{,}091$ B. T. U. per hour in the air delivered to the room, but with 80,091 B. T. U. deducted, t_2 will drop to 55°, thus

$t_2 = 300{,}000$ B.T.U. $\div$ (300,000 cu. ft. $\times$ 0.0181) = 55°

From this it will be seen that the formula used by the Terminal Company takes no account of the heating requirements, though in all cases the air must be delivered to the room at some temperature t_3 sufficiently above t_2 to furnish by cooling to t_2, the heat H_2 required to offset heat losses through exposed wall surface, and still maintain the desired temperature t_2 of the room, thus

$t_3 = (H_1 + H_2) \div (Q\,D\,C) = 85°$ in the given example where t_1 is zero, but even if t_1 rose to, say 50°, t_3 would be lowered only to [(2/7 of 85) + 50], or 74°. $H_1 + H_2$ would likewise be reduced to

$$\frac{t_2 - t_1}{t_2} = 2/7 \text{ of } (H_1 + H_2).$$

Applying this to the formula of the Terminal Company, it would be possible to approximate the seasonal steam consumption by making t_1 the average outdoor temperature for the heating season, and T the average temperature of the air delivered to the room during the same period of time, determining the new values of H_1 H_2 and T proportionately as given in the example. Of course, steam consumption would be less of a guess if records were kept of the hours the system is used and the daily average or hourly temperatures t_1 and t_3, assuming rooms not overheated, t_2 maintained (especially with temperature control), and the fan capacities approximately constant.

As far as the formula is concerned, it is not unusual, except in the sense that conditions are unusual, as it is not customary for terminal companies to heat buildings by fan systems. The formula is merely the only flat rate method applicable to conditions. Of course, there are distribution heat losses in the ducts and in the steam and return lines to the fan blast heaters which are also chargeable against the buildings, and in speaking of pounds of steam used by the buildings and car heating

* The quantity required to raise the air from the outdoor temperature to room temperature, the temperature at which it is finally discharged to the outside,—heat loss through exposed wall and glass surface being offset by some other means, such as direct radiation.

system, it is assumed that they are compared by the B. T. U. in a pound of each, especially as steam at intermediate pressure is used for car heating with returns wasted to the atmosphere. Furthermore, it is wrong to add the steam used by the buildings and pumps together and charge the balance to car heating, as the plant equipment and piping lose heat, the cost of which is chargeable against each pound of steam used for all purposes.

Theoretically, a meter rate is the only equitable method of charging, and the best method, if possible, though one large terminal company finds 4,000 B. T. U. per cu. ft. of volume per heating season giving results for office buildings approximating those obtained by their meters. Judging from similar data as published, this is a safe figure.

Cost of producing steam is often pro rated against each railroad on the "wheelage basis," that is, the car hours of usage by each railroad, or sometimes a flat rate charge is made of 185 lbs. of steam per car per hour. Actual meter records agree with this figure.

Just how the Terminal Company arrive at their method is not clear. The steam used by the pumps per I. H. P. is not stated, nor many other things, such as the head and pressure pumped against. If the pumps are for boiler-feed purposes, only the steam used to do the work of pumping water should be included in the figure given, and the cost of pumping should be pro rated against each pound of steam used in the heating systems. Heat left in the exhaust steam would be used for the buildings or feed-water heater, but the effect of back pressure on the steam cylinders of the pumps, and exhaust steam wasted to the atmosphere, if any, should also be taken into consideration.

T. W. Reynolds.

Air Cooling Requirements for Various Purposes

Sometimes the cooling of the air is done simply to remove the moisture and produce a dry air, rather than a cool air. The blast furnace furnishes an illustration of this service. Although the air must be finally heated up to about 3000° F. before going to the blast furnace, a saving of about 12% in fuel consumption may be effected by first cooling the air and removing most of its moisture. As the air with this moisture removed will weigh quite a bit less than before, the saving in horsepower required for the blower engine is apparent. Besides the saving a more uniform product will be made.

The cooling chambers are built in cells of five or six and arranged so the air can be shut from any one, thereby permitting the frost on the pipes to be melted and drained off when it is again put into service. These chambers are usually filled with 2-in. pipes on 3-in. centers and staggered so that the air must strike the pipe surfaces on its passage up through the cells.

BREAD MAKING

In the bakery business, where bread is made on a large scale, mechanically-operated dough mixers are used that will work up from 600 to 1200 lbs. of dough in one batch. The friction resulting from the beating arms causes the dough to rise in temperature. This has a bad effect on the taste of the bread and it is now considered good practice to keep the temperature of the dough near 70° F. Although the flour, yeast, etc., are mixed with water at a low temperature, the ten minutes' continual beating would raise the temperature above this point. To prevent this rise a constant supply of air cooled to a temperature of from 40° to 45° is fed into the dough mixer while it is operating. Quite often this air is washed in addition to being cooled. The air should not be dry, consequently a large quantity of air at a temperature of 45° is better than a smaller quantity at a lower temperature, as the lower temperature air would be much dryer and absorb moisture from the dough.

This air can be cooled in several ways, the simplest being to force the air through an insulated bunker filled with cooling coils in conjunction with a refrigerating machine. Another and later method is to force the air up through an enclosed tank partly filled with brine kept cold by means of an ammonia expansion coil submerged in the brine, or force the air up through a chamber partly filled with cooling coil, and through a spray of cold water where it is washed.

In this same industry it is best to keep the dough room at a temperature from 78° to 80°, which is done by cooling the air the same as for the dough mixers and circulating it through the room.

FUR STORAGE

The cooling by air circulation of fur storage rooms is becoming more general by the large department stores. A temperature of 35° seems to keep the goods in fine condition, specially where the humidity is held at 60%. The air must not be too moist or too dry. A good circulation of the air in all parts of the room is necessary, therefore, the goods should be hung not too close together.

While some fur storage rooms are installed with the cooling pipe in the room, it is impossible to control the humidity. A more successful method is to cool the air in a separate bunker filled with cooling pipe with baffles to insure proper travel of the air. The air is drawn from the fur room through the coil bunker by a blower and discharged back again to the fur storage. By cooling the air to a predetermined point somewhat below that of the fur room it will, upon rising to room temperature, have the desired humidity. Sufficient cool air must be circulated through the room to take care of the heat leak through insulated walls, the heat from artificial light and from the workman, besides that from warm goods received daily.

There are many other industries requiring the use of mechanically cooled air, such as precooling of fruit, chocolate industries, etc., but the method of cooling the air is the same as that already described in this paper.

Jewell B. Williams *before the National Association of Practical Refrigerating Engineers, at St. Louis, November 2, 1922.*

Desulphurization of Coke by Steam

A study of the action of steam on coke, with regard to the reduction in sulphur content of the coke, is being made at the Pittsburgh, Pa., experiment station of the Bureau of Mines by A. R. Powell, physical organic chemist, and S. H. Thompson, research fellow of the Carnegie Institute of Technology.

How to Face a Building to Secure Maximum Sunlight Effect

Those accustomed to figuring radiation requirements know how great a part the sun plays in reducing the heat losses on the sunny sides of a building. How to decide on the way a building should face so as to get the maximum benefit of the sunlight, both summer and winter, technically known as orienting the building, has a bearing, therefore, on the work of the heating engineer. A unique and interesting method for deciding this point is explained in detail in a manual on the subject published by the American Face Brick Association.

The feature of the manual is an "orientation chart" by which the proper exposures can be determined for both summer and winter, at various latitudes. The "orientation chart," reproduced herewith, shows the points of sunrise and sunset, on the horizon, midsummer and midwinter, as well as the direction of the sunlight each successive hour of the midsummer and midwinter day. The chart will thus aid, as far as conditions permit, in facing a building so as to get the sun or shade when wanted.

Three broad, concentric circles are shown on the chart, and beyond these is depicted the rising and setting sun for both midsummer and midwinter day. The figures, 30°-50°, alongside the sun, represent degrees of north latitude. The short arrows show the direction of the sun's rays at sunrise and sunset.

The inner circle represents the horizon, and the degrees marked upon it show the angle north or south of the direct east and west lines at which the sun rises and sets. These angles are called amplitudes and must not be confused with the degrees of latitude on the earth's surface indicated by the numbers alongside the sun.

Starting from the number indicating a given latitude, trace the arrow until it touches the amplitude circle. That point will show how far north or south of the east and west line the sun rises or sets. These points were determined by Professor Philip Fox, of the Dearborn Astronomical Observatory at Evanston, Ill.

The two outer circles are sun dials for midsummer and midwinter at the 40th degree of north latitude. The sun dial time is used on the chart, as it more universally applies at different meridians on a given latitude than does standard time. So that, if you do not find the hours marked on the summer and winter sun dials, at any time, exactly agreeing with your watch, you may, nevertheless, trust them to show accurately enough from what direction the sun is shining at different hours of the day.

The chart is drawn for midsummer and midwinter days on the 40th degree of north latitude, which is taken as the best average line that runs midway of the country from ocean to ocean.

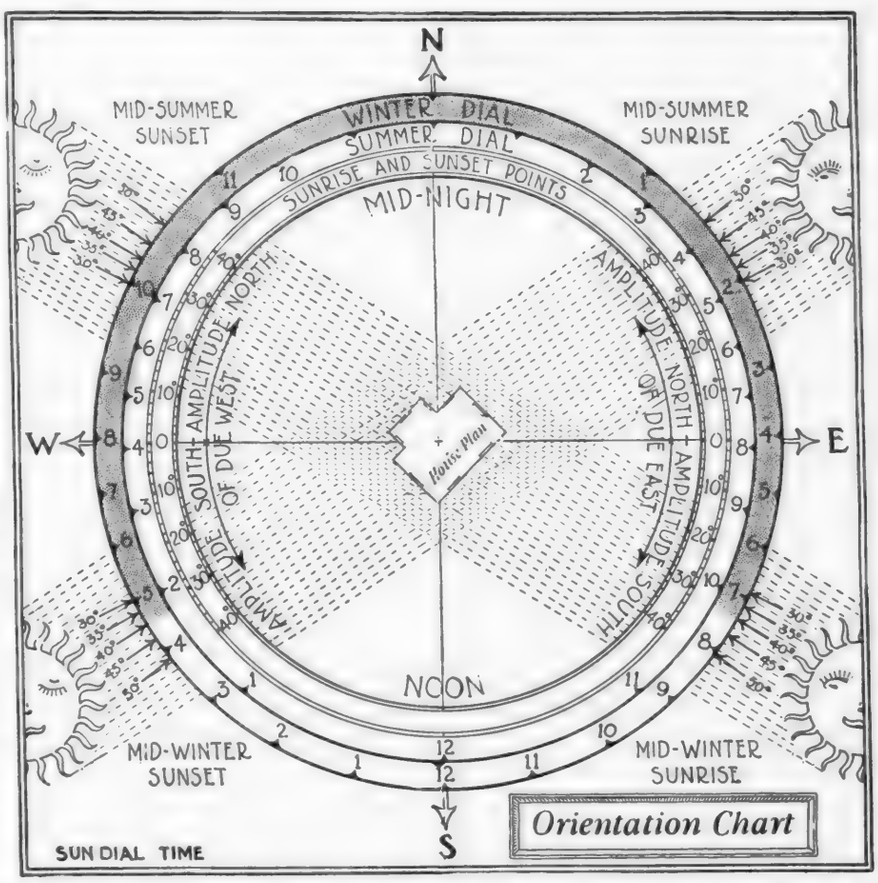
Living somewhere between 30° and 50° north latitude, the sun, summer or winter, will never pass overhead at noon, but will shine on a slant from the south, very much more in winter than in summer. This slant of the sun, however, is not so important in the placing of a house as the time and direction of sunrise at the extremes of June and December, and the position of the sun the successive hours of the day, at those times of the year.

HOW TO USE THE CHART.

To make practical use of the chart, cut a piece of light cardboard in the shape of a house, similar to the small drawing in the center of the chart. Attach it with a pin at the center of the chart, so that it may be easily turned. First place your house facing directly east. You will see that on a midwinter day, the house, facing directly east, will have the first sun between 7 and 8 o'clock in the morning on the east and south sides. At noon the east side will be deserted for the west, and from then on the south and west sides of the house will have the sun until its setting between 4 and 5 o'clock. Thus the north side of the house will get no sun at all.

By turning the house one way or another from this direct east and west position, you can see what modifications of sun and shade you get. Suppose you turn it northeast, almost facing the morning sun. The front of the house would directly get the rising sun between 4 and 5 o'clock in the morning. At 6 o'clock, the south front would come into the sunlight. At 10:30 o'clock the east front would fall into shade for the rest of the day, while the west front would begin to catch the sun. By 2:30 o'clock in the afternoon, the south side would be in the shade for the rest of the day and the north side would get the sun from then on till sunset, between 7 and 8 o'clock.

A porch on the east front of this house would be in the shade all the summer day after 10:30 o'clock. But in the winter it would not be so fortunate as the house faced to the cardinal points, for, as just indicated, it would get the sun only on two sides all day long, and yet the summer advantages might more than compensate.



ORIENTATION CHART FOR FACING BUILDINGS.

GRAPHIC CHARTS IN BUSINESS, How to MAKE AND USE THEM, *by* Allen C. Haskell, is a book written expressly for the business man, but one which will have a wide appeal to all who can make use of charts in connection with their work. In addition to explaining the different kinds of charts, simple descriptions are presented, with illustrations, of the correct types of charts to use to show any given set of facts. In connection with the book, the publishers call attention to their line of Codex data paper, which is made in numerous forms and sizes, with both plain and ratio rulings. Published by the Codex Book Co., Inc., 119 Broad St., New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE. *Price*, $4.00.

Why Ventilate Farm Buildings and How

Along with the improved methods of ventilating human habitations and places of assembly has come a recognition of the value of fresh air for cattle and domestic animals generally. Some idea of the advance that has been made in this direction is given in a recent publication issued by the Iowa State College of Agriculture and Mechanic Arts, through the college's Extension Service on Agriculture and Home Economics. The authors are W. A. Foster and F. W. Stouder. As they well state, poorly-balanced rations or insufficient food or water, in other words, starvation, is recognized by all as detrimental to growth and gain. Starvation of an animal for air is of much greater importance than temporary food or water for it impairs the health more to limit the supply of good air than to limit the supply of food and water.

Modern construction, it is pointed out, shuts out the pure, fresh air that formerly leaked through the loose-fitted siding and ill-hung doors of barns which were in use a generation ago. In like manner the foul air is shut in and confined in the animals' quarters unless some provision is made to draw off this foul air and replace it with fresh air. Indeed, some very fine modern barns are damp, musty, foul-smelling stables with wet floors and beds, just because no thought was given to ventilation. This condition encourages the occurrence of pneumonia and pleurisy, calf and pig scours, and similar diseases, and it is well-nigh impossible to control tuberculosis in a cattle herd if the animals are stabled in a poorly ventilated barn. The now very popular accredited herd work, aiming to eradicate tuberculosis, recognizes adequate building ventilations as being very important to the success of this work.

Careful tests show that the average 900-lb. cow gives off daily 1.9 gal. of water as invisible vapor from the skin and lungs. A 20-cow stable would, therefore, have

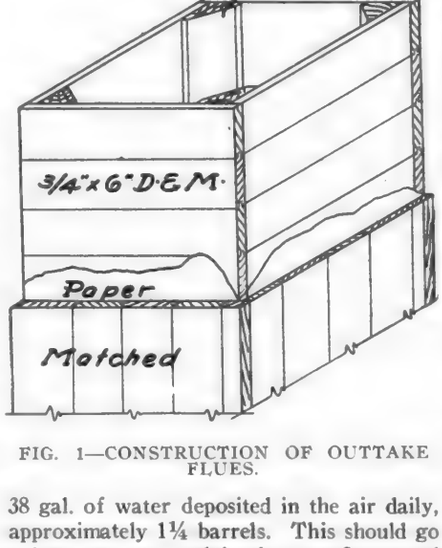


FIG. 1—CONSTRUCTION OF OUTTAKE FLUES.

38 gal. of water deposited in the air daily, approximately 1¼ barrels. This should go a long way to explain the wet floors and bedding in poorly ventilated stables.

In order to remove this moist air and keep the stables free from moisture, foul air and the "stuffy," musty odors which are present ventilation is recommended which may be controlled. When there is no control, air may be admitted through cracks in the walls and open doors and windows and this air passes out on the lee side from the wind, but drafts, particularly floor drafts, are ever-present and barns ventilated in this manner are always cold when the winds are high, or "stuffy" when the air is still.

The outtake flues of a properly installed ventilation system work on the same order as the old open fireplace. It is advisable, however, to save the animal heat, if possible, to insure a warm barn in severe weather.

The statement has been made that "the heat given off by one dairy cow per day is equivalent to 7.4 lbs. of coal burned in a furnace at 75% efficiency." Figured in Illinois coal at 45% burning efficiency, heat given off daily by each dairy cow would be equivalent to the heat in 12.8 lbs. of coal; in Iowa corn at 42% efficiency it would take 21 lbs. of corn to provide this heat. Again, figured for a seven-day or weekly period for a 20-cow dairy barn, it would take about 1800 lbs. of coal or 42 bushels of Iowa corn.

Much of this heat may be saved by proper location of intake and outtake flues of the required size. In other words, a properly installed ventilation system provides adequate air changes to insure health to the inmates, but also traps and retains much of the animal heat in the building and prevents dangerous floor drafts so common in many farm buildings.

HOW TO BUILD FLUES.

The outtake flues may be made of either wood or metal. Wood is used in systems installed by the owner or the local carpenter, while metal flues are advocated by the commercial ventilating companies. Either materials are satisfactory, *if properly insulated and correctly located.*

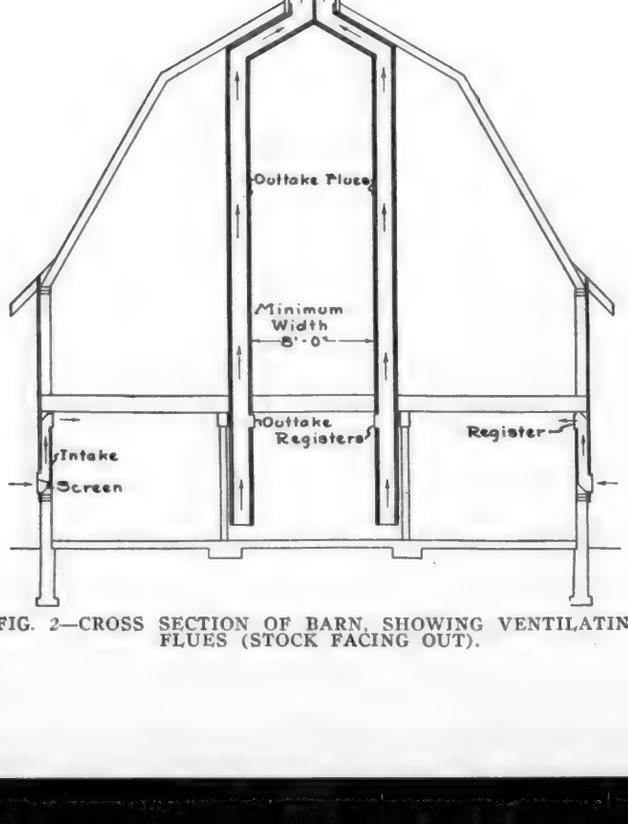


FIG. 2—CROSS SECTION OF BARN, SHOWING VENTILATING FLUES (STOCK FACING OUT).

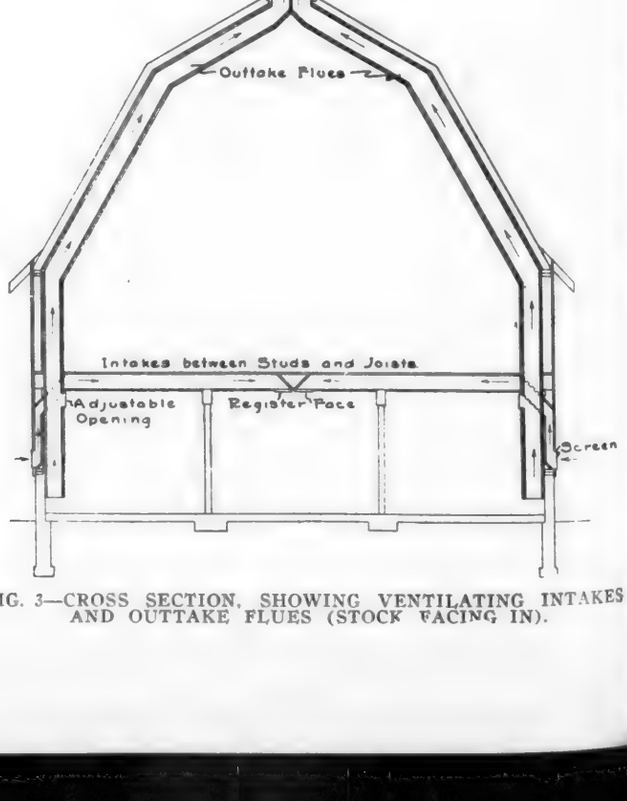


FIG. 3—CROSS SECTION, SHOWING VENTILATING INTAKES AND OUTTAKE FLUES (STOCK FACING IN).

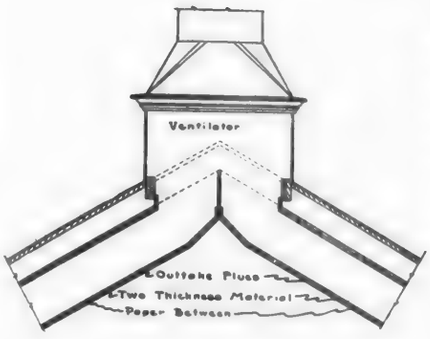


FIG. 4—OUTTAKE FLUE AT RIDGE.

Since the flue action depends largely upon the air passing upwards in the flue because it is warmer than the surrounding air, it is desirable to retain the heat and prevent the air in the flue from cooling. Careful insulation will prevent the cool air in the hay-mow from cooling the inner wall of the flue. If not insulated this would cause the moisture in the foul air to condense in the flue and be deposited in the form of frost. Furthermore, it would slow up the flue velocity and eventually stop it entirely.

The home-built wood outtake flues are made of two thicknesses of matched boards, with either an air space between, or a layer of building paper, as shown in Fig. 1.

Wood strips about 2 in. x 2 in. are used in the corners for nailing strips, and the inside boards are placed crosswise and nailed in place. Building paper is placed over this and matched boards running parallel to the flue are used for the outside covering.

In the air space flue, the inside is built in the same manner as above. Small strips about 1 in. x 2 in. are placed about the flue at four-foot intervals. The outer casing is then placed on this, the strips serving as nailing stock and holding the materials apart.

The position of outtake flues depends upon the plan of the building and the manner of placing the stalls. When the stock faces out, the outtake flues are placed over the gutter or stall floor, run vertically to the roof and are carried between rafters to the aerator at the ridge. (See Fig. 2.)

When the animals face in, the outtake flues are placed against the wall and follow the roof to the ridge. (See Fig. 3.)

The outtake flues start from a point near the floor, usually about 18 in. above the floor. An opening is also placed in the outtake flue just below the ceiling, which is controlled by a gate or slide. This opening may be opened when it is desired to draw off the warm air near the ceiling and will be found an efficient means of cooling the stable on warm summer days. It is desirable to place a damper or shut-off in the outtake flue also, so it may be regulated to suit weather conditions and the number of animals sheltered, as well as wind velocity across the top.

NUMBER AND SIZE OF FLUES

Outtake Flues. The number and size of outtake flues depend upon the size of barn and number of animals housed. In the small barn the outtake flues may be kept near the end. In a long barn they should be evenly spaced throughout the length of the building to insure greater efficiency.

A mature steer or cow will require 3600 to 4000 cu. ft. of air each hour, or about 65 cu. ft. per minute, to maintain the required purity. A barn 36 ft. x 64 ft. has floor space that would accomodate three car-loads of steers, or about 60 animals. Since one steer requires 65 cu. ft. of air per minute, 60 steers would require 60 ft. x 65 ft. or 3900 cu. ft. per minute. Assuming the air to travel 250 ft. per minute in the outtake flue (which is a safe average) it will require 16 sq. ft. of flue capacity or four flues of 4 sq. ft. each. This would require a flue 2 ft. or 24 in. square on the inside. Since the barn is 64 ft. long, it would be better to have three pairs of smaller flues. This allows better distribution, smaller flues and aerators. Dividing 16 sq. ft., the total flue area, by 6, the number of flues, we have 2⅔ sq. ft. or 384 sq. in., the required size of each flue. This would require a flue slightly less than 20 in. on the inside to furnish the required area. The full 20-in. inside measurement should be used.

The outtake flues should connect with the ventilator or aerator as shown in Fig. 4.

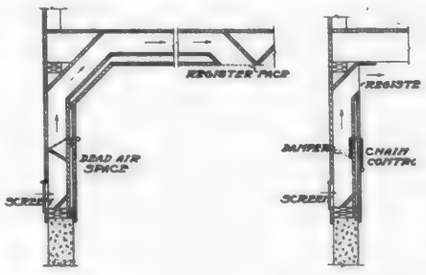


Fig. 5—Stock Facing In. Fig. 6—Stock Facing Out.

INTAKE FLUE CONSTRUCTION.

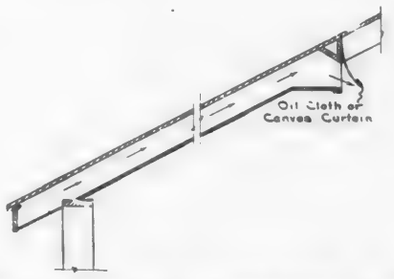


FIG. 9—DETAIL OF BACK-DRAFT PREVENTION IN FRESH-AIR INTAKES.

4. The division board upward at intersections of flues is important, as it prevents the air reversing its direction or backdrafting in either flue.

Aerators may be of wood or metal. Since the metal aerator has been developed, it is used much more than the wood type built by local labor on the building during erection. The metal type is more efficient, the cost is not high, little labor is required for setting it in place and it presents a good appearance. The wood type leaks air; it is a harbor for birds; it is not efficient, and it is hard to build, which makes its use unpopular. Furthermore, too much individuality of the owner or builder is attempted in the appearance and the use is lost sight of.

Good metal aerators may be purchased from the manufacturers or material yards. Secure a heavy galvanized metal and a size large enough to care for outtake flues and in proportion to barn.

Intake Flues are usually placed in connection with the windows in the sidewalls of the barn. The openings on the outside are placed about 4 ft. above ground, or just above the window sill. The passage extends upward in the wall to a point near the ceiling of the stable or the joists supporting the mow floor. The passage either opens directly into the barn for stock "facing out" (Fig. 5), or it is extended over to the center of the barn, as shown in Fig. 6, for stock "facing in."

It is desirable to place a screen over the outside openings to prevent birds entering

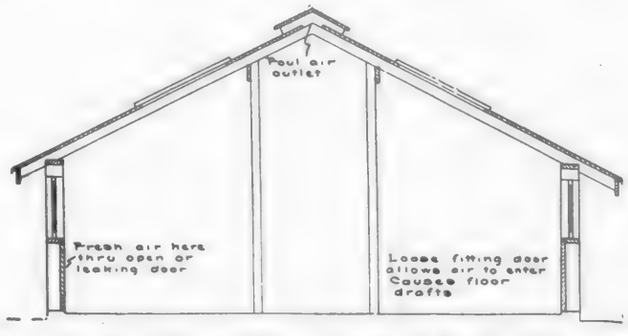


FIG. 7—COMMON VENTILATING SYSTEM FOR HOG HOUSE (RUTHERFORD PRINCIPLE).

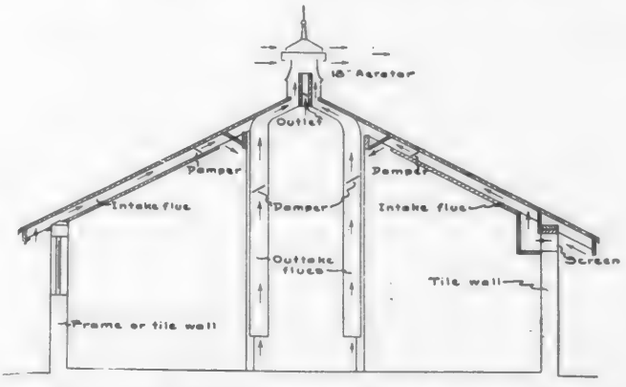


FIG. 8—KING VENTILATING SYSTEM FOR HOG HOUSE.

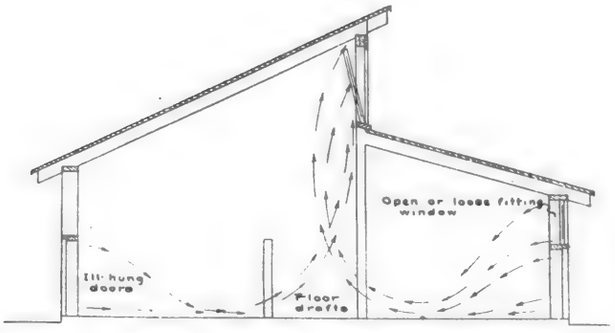


FIG. 10—A COMMON BUT UNSATISFACTORY VENTILATION SYSTEM.

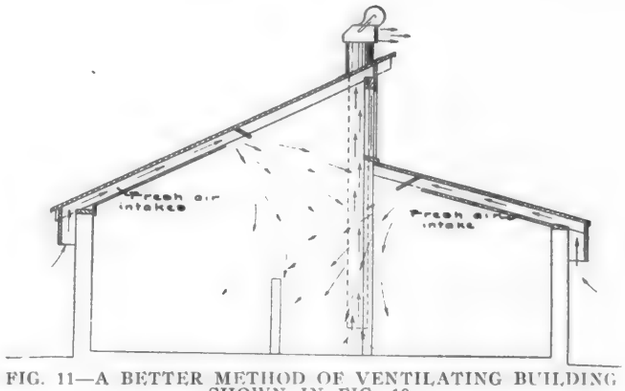


FIG. 11—A BETTER METHOD OF VENTILATING BUILDING SHOWN IN FIG. 10.

the passages. A damper in each passage will allow regulation and permit shutting off part of the intakes in cold weather or when the barn is not used to full capacity. The inside openings may be open, but the register faces or screens will prevent anything entering from the interior of barn.

The air intake and out-take flues should be built tight, so air will not leak from them. The mow floor should be tight, and the walls should be built so the air will not leak through. All silo and hay chutes should be closed to prevent interference with the ventilation. The doors and windows *must be kept closed* to have the ventilation system work satisfactorily.

THE GAMBREL OR RIDGE TYPE OF HOUSE

The common ventilating system for the gambrel-roof hog house is shown in Fig. 7. The foul air is drawn off at the ridge through small ventilators or a low monitor. Many times neither are provided and the air passes out through the open roof windows. While this practice is much used, it is faulty because a drafty house results. No provision is made for fresh air to enter. The air drawn off at ridge must be replaced by fresh air which rushes in through open doors and cracks about the doors. *Floor drafts are produced which are disastrous to the swine family.*

The same conditions hold for the gambrel-type house.

A recommended system for the gable or gambrel-type hog house is shown in Fig. 8. Out-take flues are built of wood or metal and they extend to a point near the floor, —12 to 14 in. from the floor. Dampers are placed in the flue to regulate the amount of the air passage, which is necessary when only a portion of the house is used or when wind velocity is high outside.

Frequently the out-take flue in the alley way or drive way requires much needed space. A telescoping flue or a sized canvas extension may then be used for the lower portion of flue. This may be removed when cleaning or driving through the house.

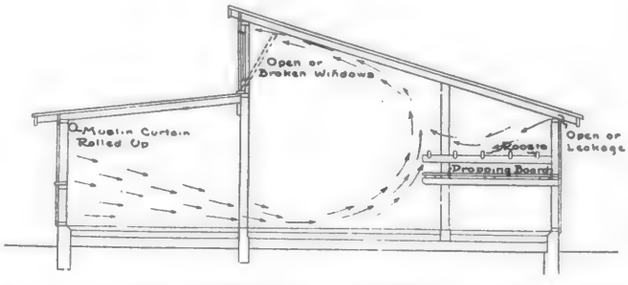


FIG. 12—A GOOD VENTILATION SYSTEM IN SUMMER, BUT DISASTROUS IN WINTER.

An outlet is also shown in the ventilator to draw off in summer, the warm air, which pockets under the roof. This warm air should be saved in winter, because it acts as a blanket or covering and prevents heat loss, just as a cloudy sky will prevent frost in early October.

The intake flues are made by boxing in the space between two adjoining rafters. They should extend to a point nearly over the front of the pens to prevent the cold air from falling directly upon sleeping pigs. Dampers are placed in the intake so that they can be adjusted from the front of the pen or alley way. It is also desirable to place a screen over the outside openings to prevent birds nesting in the intake flues.

When wind conditions are unfavorable there may be a back draft in the intakes. Commercial organizations have adopted an automatic shutter which will close and prevent the air from passing in the wrong direction. It is a simple matter to hang an oil cloth or canvas curtain over the intake mouth as shown in Fig. 9. Any tendency to reverse the air flow is immediately shut of by the curtain.

THE HALF MONITOR TYPE HOUSE

Many users of the half-monitor house have felt that no ventilating system is necessary because in this type of house, the open windows care for the ventilation. While it is common to depend on this window ventilation, it is an expensive system (Fig. 10) because floor drafts are always present.

The half monitor house with out-take and intakes is shown in Fig. 11.

It is well known that the hot air furnace will not heat a home when doors or windows are left open. Air currents or drafts interfere with the heating. Likewise open windows and doors cause the ventilating system to work badly. All windows should be closed and close fitted. Furthermore, replace all broken panes and see that all glass is puttied in place.

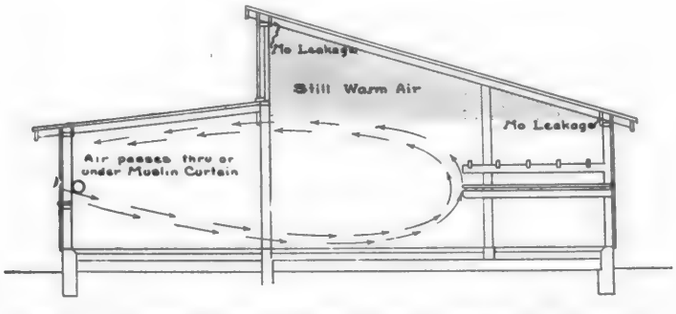


FIG. 13—A MUCH-USED VENTILATING SYSTEM FOR THIS TYPE OF POULTRY HOUSE.

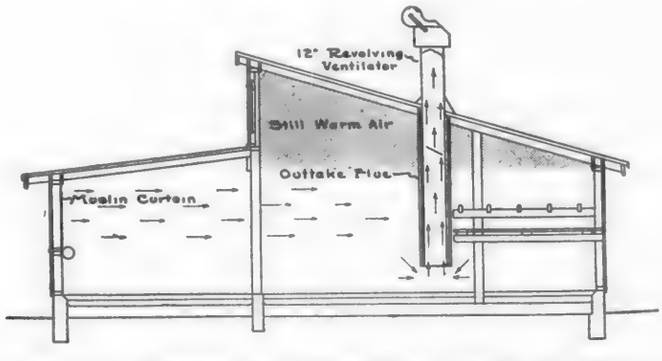


FIG. 14—A SYSTEM WHICH PROVIDES FRESH AIR WITH MINIMUM LOSS OF HEAT IN WINTER.

POULTRY HOUSE VENTILATION

The hen carries a heavy load of work in furnishing its food product. Until recent years, the hen rustled for herself, or went hungry, and at night she roosted on the cow stanchions or stall partitions and in the apple or box elder tree.

The modern hen lives in a palace compared to the hen of a generation ago. And yet, too little attention is paid to ventilation. The popular open-front, half-monitor house is so successful because it is least susceptible to the drafts so common in the poultry house. The air enters through the open front open cornice and has its exit through the broken or open windows. (Fig. 12). The open cornice should not be allowed and the open or broken cornice window draws off the air so that the floor is cold and drafty.

Fig. 13 shows a house in which the warm air is pocketed at the top. This is desirable in winter because it prevents air currents over the roosts and retains much of the heat. Fig. 14 shows this house provided with an out-take flue. One square foot of outtake flue will care for 200 to 300 birds. Since the average poultry house will care for 150 fowls, make the out-take flue smaller. Use a 12-in. ventilator and an out-take flue 9 to 10 in. square, inside measurements. A 12-in. round metal flue may be used if desired.

Since floors and other drafts are encouraged by a long house, it is desirable and advisable to keep compartments of the house small,—not over 24 ft. in length. This will not only allow fowls to be divided into groups, but the health of the birds is safeguarded.

A damper or shut-off should be provided, and good judgment—common sense—should be used in the regulation.

Heating and Power Costs for Office Buildings.

Attention has been called to the fact that in the article published in THE HEATING AND VENTILATING MAGAZINE for January, 1923, on "Heating and Power Cost Analysis for Office Buildings," Building No. 138 and Building No. 70, one located in Dayton, O., and the other in Detroit, have approximately the same radiation and yet the Detroit building is credited with one-third the steam consumption of the Dayton building.

These figures appeared in the Accounting and Exchange Report of the National Association of Building Owners and Managers and an explanation of the apparent discrepancy is furnished by Lewis B. Ermeling, executive secretary of the association, who states that the Detroit building is located on a lot of nearly double the area of the Dayton building, and the building itself is just half as high. It is very probable that, being a low building in the down-town district, it is surrounded and that this is the reason why a smaller amount of steam is used for heating.

"In addition to the above facts," continues Mr. Ermeling, "you will note that the Dayton building uses a large amount of steam and this is probably further explained by the occupancy. We find that many of our members have made real economies by studying their heating problem, and turning off the heat late in the afternoon. This has also been done for a time during the middle of the day."

Some Practical Gasket Hints.

"The greatest difficulty I have encountered during my ten years of experience with gaskets," says Henry Bohmer, Jr., of the Flexitallic Gasket Co., Camden, N. J., "has been to convince users that it is not necessary to tighten a thick flexible metallic gasket with the same extreme pressure as must be applied to thin non-flexible gaskets.

"The idea seems to prevail," continues Mr. Bohmer, "that a gasket, in order to prevent leakage, must have as little thickness as possible and must be squeezed so thin that the distance between the faces of the flanges is a very close approach to absolute zero. Very often when applying gaskets we see the engineer or pipe fitter slip a pipe over the wrench, thereby increasing the wrench's leverage and making it possible to still further increase the pressure against the gasket. As a result the gasket is squashed. If it is made of corrugated metallic material it is flattened out so flat that the corrugations can do no good whatever.

"It is poor practice to slip a pipe over ANY wrench on ANY gasket because wrenches are generally made of a proper and safe length to fit the nut for which it was intended, and nut sizes are usually standardized to fit certain bolt diameters. This is a logical safety measure that has been almost universally adopted so that the bolt will not be subjected to too great tension. An extra-long-handled wrench, unless used with extreme care, is liable to either break the bolt or strip the threads.

"One serious objection to the very thin gasket is that no matter how it is constructed it can have but little expanding or contracting capacity, consequently all expansion and contraction must be taken care of in some other manner—by means of pipe bends or expansion joints. A thicker gasket, having elastic properties, will naturally take care of considerable expansion and contraction. In many cases I have known thick flexible gaskets to take care of all of the expansion and contraction in the line—under ordinary temperature conditions of non-superheat practice.

"Where temperatures are high, or where temperatures fluctuate considerably, copper, brass and other metallic gaskets having a co-efficient of expansion different than that of the joint, should not be used. On account of the difference in the co-efficient the gasket and the joint tend to expand and contract independently of each other. The tightly-bolted joint, being much stronger than the thin gasket, will compel the gasket to expand and contract along with it. Breakage and leakage of a serious nature are, therefore, often the result. A gasket made up of steel, which has the same co-efficient of expansion as the joint, overcomes this latter trouble entirely, but if it is thin and non-flexible it does not overcome or assist in overcoming the longitudinal expansion troubles.

"Hence when applying thick flexible metallic gaskets, be certain that a wrench of the correct length is used and then tighten only enough so that the leakage is prevented. Do not tighten too tight. Any further tightening after leakage is stopped simply reduces the elasticity of the gasket and does not give it an opportunity to "breathe" as it should simultaneously with the expansion or contraction of the pipe line."

Use of Kata-Thermometer Proposed for Establishing Standard of Theatre Ventilation.

A committee which has attempted to establish a standard for the ventilation of theatres and motion picture houses in Johannesburg proposes the use of the kata-thermometer in fixing such standards. For the Johannesburg theatres and picture houses, states the report, a "dry kata" figure of not less than 5 and a "wet-kata" figure of not less than 16 indicate a reasonably good condition. Of these records, continues the report, the "dry kata" figures are, for sedentary gatherings, the more important. In connection with the standards recommended it is further provided that in no case shall the "dry-kata" figure indoors be required to be higher than 1.5 below that obtained in the open air immediately outside the building.

The same committee recommends a standard for factories and workshops of a "dry-kata" figure of 6 and a "wet-kata" figure of 18, where reasonably practicable.

Income Tax Facts.

Revenue officers are visiting every county in the United States to aid taxpayers in the preparation of their income tax returns for the year 1922. Information concerning the date of their arrival and the location of their offices may be obtained by writing the collector of internal revenue for the district in which the taxpayer lives.

Forms for filing returns of individual net income for the year 1922 are being sent to taxpayers who filed returns for the year 1921. Failure to receive a form, however, does not relieve the taxpayer of his obligation to file a return and pay the tax on time, on or before March 15, 1923. The forms, 1040A for filing returns of net income $5,000 and less and 1040 for filing returns of net income in excess of $5,000, may be obtained from collectors of internal revenue and deputy collectors.

Returns are required of every single person whose net income for 1922 was $1,000 or more or whose gross income was $5,000 or more and of every married person whose net income was $2,000 or more or whose gross income was $5,000 or more. Careful study of the instructions on the forms will greatly aid in making a correct return.

Why There Is a Need for Industrial Standardization

By Albert W. Whitney,

Chairman, American Engineering Standards Committee.

The need for standardization arises out of two situations. In the development of a new project the first in the field are the inventors. Of necessity they have to try out a large number of ideas; many of these prove to be useless and of those that are valuable some are better than others. Inventors are not the people to clear up the confusion in which they have left things; that is not their business, but somebody must make a selection among this confusing and unnecessary variety.

In addition the field gets unnecessarily littered up by the casual development of the business, largely through competitive influence exerted through the sales organization.

It is the job of the standardizer to take care of both of these situations; he must out of this variety select those things and those ideas that are best worth keeping.

This has two effects. It produces greater efficiency; by a reduction of the multiplicity of processes and products it allows for concentration on those that are worth while; the resulting increase in efficiency is effective all along the line, not merely in manufacturing but in selling and in buying. This is the common view of standardization and is so well understood that I need not dwell on it further.

But in addition to this, standardization does something else that is equally important. It frees the human spirit for making further advances. If there were no standardization the creators of ideas would have to be continually recreating and would have no time for further advance. Whenever a bolt or an I-beam or a generator was needed it would have to be a matter of design. Standardization allows such needs to be taken care of through routine process and the creative spirit is relieved for fresh first-hand adventures.

Standardization instead of killing invention and initiative is the very basis upon which it rests. It is standardization that makes further invention possible.

THE DANGER IN STANDARDIZATION

There is a danger in standardization, the danger of too early standardization and too drastic standardization but there is a danger connected with the use of any powerful instrument. The problem of civilization and progress is to a very great extent a problem in the wise use of standardization.

There are three organizations that are bearing the brunt of this work, the United States Chamber of Commerce, the Department of Commerce of the Federal Government and the American Engineering Standards Committee.

The United States Chamber of Commerce is doing a valuable work in interesting manufacturers in standardization and particularly in simplification. It has been the direct cause of considerable work that has been done in this field that is of a national character.

The Department of Commerce is advancing standardization in two ways; in the first place, through the Bureau of Standards, a very valuable adjunct to the government. The Bureau of Standards, both as a research institution and as a co-ordinator of government activities in standardization and as a co-operator with industry itself, is doing a most valuable work.

In addition to the Bureau of Standards, Mr. Hoover has initiated a new department known as the Division of Simplified Practice which is engaged on the non-technical side of the field of standardization. It endeavors to bring manufacturers together through their trade associations in adopting comprehensive plans in reduction of the unnecessary variety that is found in industry.

The third national standardizing body is the American Engineering Standards Committee. This was founded four years ago by a number of leading engineering societies. At present the membership consists of: the mechanical engineers, the civil engineers, the mining engineers, electrical engineers, the Society for Testing Materials, and the automotive engineers; the government departments of the Army, the Navy, Commerce, Agriculture, the Interior, the Panama Canal, electrical manufacturers, the central stations, both electrical and gas; the steel manufacturers, the architects, the steam and electric railroads railways, fire protection interests and the safety interests.

This body serves as a clearing-house for standardization. It does not initiate standardization projects, nor does it do standardization work itself. It encourages standardization and it provides a general outline of procedure which if followed will entitle the standard to be listed as an approved American standard. This standard is in no sense mandatory but in actual practice it does to a very considerable extent, because of its intrinsic merit and the representative way in which it was produced, become the American standard in its field.

HOW STANDARDS ARE MADE.

The process is this: When there has been brought to our attention in a convincing way the fact that there should be standardization in a given field, a conference is called and to this conference are invited all national associations and other representative bodies that are known to be interested. This conference decides whether standardization should be undertaken and if the decision is in the affirmative it makes a recommendation to that effect to the American Engineering Standards Committee and also with regard to the national association or other representative body which shall act as sponsor in the preparation of the standard.

The sponsor that is chosen by the American Engineering Standards Committee creates a sectional committee. This sectional committee is not a committee of the American Engineering Standards Committee but directly represents the bodies that are interested in the particular standardization project. When the sectional committee has completed its work the standard is turned over to the American Engineering Standards Committee for approval. The American Engineering Standards Committee does not pass upon its technical details but solely upon the question of whether the work has been performed in a thoroughly representative way.

The American Engineering Standards Committee has more than 120 projects under way at the present time, 28 of which represent standards that have been actually approved. On the last count, I believe there were 22 national associations that were working on sectional committees represented by some thousand individuals.

Fifteen Million People Live in Zoned Cities.

More than 15,000,000 people live in zoned cities, towns and villages, according to information made public by the Division of Building and Housing of the Department of Commerce. Computations show that the home of 27% of the total urban population of the country are located in zoned municipalities, and it follows that most of these homes are protected from intrusion of garages, stores, warehouses or manufacturing plants.

Zoning regulations provide, by a neighborly kind of agreement, that a city or town shall be divided into districts in which the uses for which structures may be built, their maximum height, and the area of the lot which they may cover, are established. In line with the zoning plan, certain districts are set aside for residences, for apartment houses, for office buildings, and for manufacturing. Ample provision is made for normal growth of business and industrial districts, but the builder of a garage or factory is not allowed to erect it within a residential neighborhood regardless of the annoyance and money losses inflicted on surrounding home owners.

In the entire country, 109 cities, towns and villages were zoned on January 1, 1923, as compared with 55 just one year before.

The complete list of zoned municipalities, as of January 1, 1923, with references to the State acts under which zoning is permitted, may be obtained from the Division of Building and Housing of the Department of Commerce, which also has available for distribution such pamphlets as "A Zoning Primer," explaining in popular style the elements of zoning, and "A Standard State Zoning Enabling Act," a model act for the assistance of States in preparing laws permitting city zoning.

Ozone in Ventilation

In view of the renewal of the discussion of recirculating air in ventilating work, accompanied by the use of Ozone, there is timeliness in a paper by Charles G. Huntley, which was read before the (British) Institution of Heating and Ventilating Engineers at its recent annual meeting in Birmingham, England.

Discussing the historical aspects of the subject, Mr. Huntley said that so long ago as 1785, Van Marum observed that oxygen through which an electric spark had been passed possessed a peculiar smell, and at once tarnished a bright surface of mercury, but it was not until the year 1840 that the attention of chemists was again called to this fact by Schönbein. This celebrated chemist showed that the peculiar, strongly smelling substance, to which he gave the name of Ozone, was capable of liberating iodine from potassium iodide, and of effecting many other oxidising actions.

For many years much doubt existed respecting the exact chemical nature of this oxidising agent, for the simple reason that it was found impossible to obtain ozone except in very small quantities, and that an exact investigation of its composition was rendered still more difficult by its extremely energetic properties. Researches, however, conducted with the greatest care, have shown that ozone may be regarded as nothing more than *concentrated oxygen*. To Andrews belongs the credit of having first proved that ozone, from whatever source it may be derived, is one and the same body, having identical properties and the same constitution, and also that it is not a compound of two or more elements, but oxygen in an allotropic form.

PROPERTIES OF OZONE.

The chemical formula of ozone is O_3, that is, each molecule of ozone is made up of three atoms, whereas the molecule of oxygen has only two. It is a curious feature of the state of allotropy that the allotropic substance always differs so widely in all physical characteristics from the original, and ozone is a striking example.

The following table shows, on one side, some of the properties of oxygen, and on the other the corresponding properties of ozone:

PROPERTIES OF OXYGEN at 15° C.	PROPERTIES OF OZONE at 15° C.
Molecular Weight, 32.	Molecular Weight, 48.
Weight of a cubic foot 0.08926 lbs., 1 litre = 1.4298 Gms.	Weight of a cubic foot, 0.13389 lbs., 1 litre = 2.1447 Gms.
Boiling Point—181.4°C.	Boiling Point—119°C.
Very stable at all temperatures.	Commences to disintegrate at about 100°C.
Feeble, oxidizing agent.	Powerful oxidizing agent.
Inodorous, colorless, tasteless.	Pungent smell, bluish color and possesses strong metallic taste.
No effect on—Blue Litmus.	Bleaches Blue Litmus.
Potassium Iodide.	Decomposes Potassium Iodide, liberating Iodine.
Ammonia.	Oxidizes Ammonia into Nitrate.
Hydrochloric Acid.	Decomposes Hydrochloric Acid, liberating Chlorine.
Phosphoretted Hydrogen.	Oxidizes Phosphoretted Hydrogen with production of light.
Silver.	Oxidizes Silver.
Rubber or Cork.	Rapidly corrodes rubber, and, less rapidly, cork.

The whole secret of the value of ozone lies in its power of oxidation. It is indeed one of the most powerful oxidizing agents known, which is due to the fact that it readily parts with the third atom of oxygen contained in the molecule. The conversion of oxygen into ozone, may, for simplicity, be expressed chemically by the equation $O_2 + O = O_3$ (the correct equation is $2O_2 + O_2 = 2O_3$), and it is this third atom which splits off so easily and enters into combination with other bodies, which is the basis of its value. This third atom at the instant of splitting off is often described as "nascent oxygen."

Mr. Huntley also took up the commercial application of ozone and quoted at length from the tests reported by Edwin S. Hallett, chief engineer of the St. Louis Board of Education, on the use of ozone in the St. Louis public school buildings. He concluded with a description of an English type of ozone generator.

Safe Construction of Built-in Garages.

"Motorists who keep their cars in built-in garages, or garages attached directly to the side of their dwellings do not run an undue fire risk if they follow certain elementary precautions," states Ira H. Woolson, chairman of the Building Code Committee of the Department of Commerce, and consulting engineer of the National Board of Fire Underwriters, in an interview just given out. "We covered the subject of built-in garages for one and two-family houses quite thoroughly in the Recommended Minimum Requirements for Small Dwelling Construction that have just been published by the Department of Commerce," states Mr. Woolson, "and gave directions for constructing them safely, that can be followed by any competent builder."

For the sake of motorists and builders who desire complete directions, Mr. Woolson has prepared a statement, giving the six rules from the code, together with the directions for carrying them out, as given in the appendix, with a few changes to simplify the wording, which was a little more technical in the original in order to make the rules more practical to enforce:

Rule 1. Garage floors shall be of concrete or equally fire resistive and impervious material.

Rule 2. Walls and partitions shall be built to meet the requirements of the standard one-hour test.

Rule 3. The combined floor and ceiling construction directly above the garage shall be unpierced, and shall have a fire resistance of one hour. The same rule applies to the roof when the garage is attached to the side of the dwelling.

Rule 4. When a garage is located beneath a dwelling, all outside doors and windows with their frames and sash shall be of standard fireproof construction, and glazed with wired glass.

Rule 5. Openings from a dwelling into a garage shall be restricted to a single doorway. This opening shall be protected by a standard swinging, self-closing fire door, with approved fire-restrictive frame and hardware. No glass shall be permitted in such a door.

Rule 6. When a doorway connects directly with a cellar or basement on the same or lower level in which there is any heating device or gas fixture, the door sill shall be raised at least one foot above the garage floor level, or the doorway shall lead into a vestibule which connects with the cellar or basement by a second door.

This is to prevent fumes from gasoline which may leak or be spilled upon the floor from reaching a furnace fire or gas light that might be located in any lower portion of the building. It is well known that gasoline vapors are heavier than air, and will accumulate on a floor like water, and flow to any lower level, and if they come in contact with fire of any kind—even a spark—will ignite and flash back to the starting point, and cause an explosion. Hence the high door sill.

Electrified Sand Brings Rain.

Wide interest is being expressed by physicists in the series of experiments conducted at McCook Field, near Dayton, O., in which electrically-charged grains of sand have been used with success in causing precipitation from clouds. The experiments were conducted by Professor Wilder D. Bancroft of Cornell University and L. Francis Warren.

The results of the experiments were described as "absolutely uncanny" by observers at the army air field. The clouds were made to disappear and precipitate their moisture by the dropping of the electrified sand, which was accomplished from airplanes. A La Pere plane was used, carrying about 80 lbs. of sand, of about 150 mesh, with a wind-driven generator operating an electrical equipment capable of charging the sand with high voltages, either positively or negatively. The sand was charged to approximately 10,000 volts, or a charge of the order

of 0.0006 electrostatic units per grain. It was scattered at about a height of 500 ft. above the clouds, with the plane traveling 100 miles an hour.

The time taken to precipitate and disintegrate the clouds rarely exceeded 10 min. and in several cases was less than five minutes. The temperature and general climatic conditions were variable.

Some of the experiments, said Mr. Warren, were followed by snow flurries over the flying field and light rainfall over the adjacent regions.

For artificial rainmaking on a broad scale, it is proposed to use sand powdered to sizes that will fall slowly and be dispersed over a wide area. One or more tons of minute dust particles as fine as talcum powder and which, when scattered, will cover enormous areas, will be carried by a plane flying 70 to 80 miles an hour and liberated as a catalyctic agent, at the rate of about 25 to 30 lbs. a minute.

Among those who have expressed confidence in the possibilities of the experiments is Dr. Michael I. Pupin, who said he thought it likely that the process would prove to be one of the greatest inventions of the age. Dr. Augustus Trowbridge of Princeton expressed the opinion that the theory seemed absolutely sound and that it seemed to be a question of engineering whether the theory could be applied on the large scale necessary to produce artificial irrigation from the sky for the benefit of farmers in dry years or in arid sections. Dr. N. W. Hering, professor of physics at New York University, said that no rain-making process that sounded so reasonable or that was backed by such scientific authority had ever been announced before.

On the other hand a dissenting view is expressed by Dr. William Jaskson Humphreys, physicist of the United States Weather Bureau, who states that nothing which has come to his knowledge regarding the Bancroft-Warren tests would lead him to believe that the results will be of practical value to the world.

"The idea of using electrically-charged sand to dispel fog," said Professor Humphreys, "is not novel. We know that if a strongly-electrified object were placed on a desk it would attract certain objects to it. I have little doubt that if strongly-electrified sand were placed in the air above a fog, the sand would have an attraction for the fog. But you would have to pour too much electrically-charged sand from above down upon clouds. You can also get rid of a certain fog by building a fire, but it would take a lot of fire to drive away a London fog."

Extent of Electrical Heating in Seattle.

Electric heating is a success when homes are especially built for that purpose, in the opinion of the Seattle section of the American Institute of Electrical Engineers, as expressed at a recent meeting. The results of electrical heating were discussed, with the conclusion that houses should be built to retain heat if the use of electricity is to become both economical and efficient.

More homes are heated by electricity in Seattle than in any other city in the United States, it is claimed, a total of 1,978 being so heated during 1922. This is due to the low heating rate of $9 a kilowatt per year, and only the limited capacity of the present city waterpower plant prevents many additional families from adopting electrical heat.

Work by the city of constructing a new power plant on Lake Cushman is now in progress, and with its completion, in a year or two, a great increase in the use of electricity for heating and cooking is anticipated.

The city's income from electrical heating is now more than $100,000 annually.

Keeping Warm in Persia.

Coal stoves and steam heat are unknown in Persia. Many will remember the description given by L. A. Scipio, former acting director of the A. S. H. & V. E. Research Laboratory, of the "koerse" used in that part of the world for domestic heating. We are fortunate in being able to present a typical photograph of a home in which the inmates

are managing to keep warm with this arrangement. The "koerse" is nothing more than a table placed over a tandoor, or pan of charcoal, and covered with a carpet to keep in the heat. The members of the family gather round this table and stretch their legs beneath the table.

New Plan for Financing American Engineering Standards Committee.

A new plan for financing the American Engineering Standards Committee in its industrial standardization work, which provides for membership dues on the basis of one cent per $1000 of gross receipts, has been formally approved by the executive committee of the A. E. S. C. Twenty of the most influencial industrial executives of the country have accepted places on an advisory committee which will cooperate with the Ways and Means Committee in the refinancing of the A. E. S. C.

In submitting the report of the Ways and Means Committee, A. W. Whitney, chairman of that committee and of the A. E. S. C., declared that the economies which should accrue to the industries of America through standardization, "are to be measured in billions of dollars, not millions."

The American Engineering Standards Committee, which was organized in 1918, has heretofore been financed entirely by dues from the nine technical societies and seventeen national trade associations which with seven departments of the federal government constitute its present membership. Annual deficits were cleared by contributions from individual corporations.

It is expected that the new plan of financing will provide an annual budget of $50,000 for the Standards Committee. As this sum is to be realized from sustaining membership dues amounting to 1/1000 of 1% of gross receipts, the total of $50,000 would be spread over industries with aggregate gross annual receipts of five billion dollars. For firms which for any reason prefer to subscribe on the basis of capital, rather than gross annual receipts, the recommended basis is 1½ cents per thousand dollars of aggregate market value of the corporate securities of the firm.

Powdered Coal for Generation of Steam.

In co-operation with the Combustion Engineering Corporation, tests are to be conducted by the Bureau of Mines at the River Rouge plant of the Ford Motor Co. on the largest boilers so far constructed. These tests will supplement the knowledge gained in previous tests on differently designed boilers when heated by powdered coal.

American Society of Heating and Ventilating Engineers

Illinois Chapter Discusses Chicago Heating Contractors' Code

A presentation by Charles D. Allan of the code of the Standardization Committee of the Chicago Master Steam Fitters' Association for figuring radiation and boiler capacities held the interest of a large gathering at the February meeting of the Illinois Chapter, held February 12 at the Chicago Engineers' Club. Mr. Allan showed several slides of the rules and explained their operation. He also showed two slides in which the rules were condensed so as to make the equation more concise.

H. M. Hart, president of the Chicago Master Steam Fitter's Association, told of some of the early difficulties encountered in making up the code. As a result of its adoption, he said, the speculative house builder is obliged to install his heating plant according to these rules or else he is obliged to get an outsider to do the work. The code, he said, has been in force since 1916.

Louis Braun secretary of the Chicago Master Steam Fitters' Association, told of the operation of the code which, he said, is generally supported by the architects and builders.

Other speakers were Homer Linn, of the American Radiator Company, and Charles F. Newport, of the Newport Boiler Company, who made a plea for adequate sized chimneys. Mr. Newport urged a smoke test for new chimneys. He stated that 5 ft. should be added to the chimney height for every right angle turn in the smoke pipe between the boiler and the base of the chimney.

Seventy-nine members and guests were present. New members elected were Frank E. Moran and Thomas C. Douglass.

(The rules of the Chicago Master Steam Fitters' Association applying to boiler capacities for direct radiation are given in THE HEATING AND VENTILATING MAGAZINE's Data Sheets Nos. 49-B and 49-C.)

Recirculation of Air Taken up by New York Chapter

News of important developments in connection with the recirculation of air in ventilating work lent a timely interest to the discussion of this subject at the February meeting of the New York Chapter, held February 19, at the Building Trades Employers' Club. The fact was brought out that the New York City Department of Education is seriously considering recirculation of air together with the use of ozone in the new school buildings which are now being designed. The announcement that the present building plans call for an outlay of $53,000,000 indicated what a far-reaching effect such a step might have in shaping the trend of modern ventilating practice.

John P. Morris, of the Air Conditioning and Engineering Co., of St. Louis, presented a paper outlining the experiments conducted at the Bryan Mullanphy school, in St. Louis, a year or two ago, in which recirculation was used in connection with electric ozonators. These tests were made at the instance of the St. Louis Chapter of the A. S. H. & V. E. and were reported at the time. Mr. Morris also discussed the general subject of ozone, making the statement that nitric oxide is a function of voltage and little else. "Early practice," he said, "was to make ozone machines without dielectrics but as the machines got hot, sparking resulted, and in order to overcome the tendency of their machines to spark, experimenters and inventors used dielectrics. Thus it follows that with a machine using a dielectric, sparking does not occur, nor does the formation of nitric oxide become a problem, for without sparking nitric oxide cannot be formed."

Among those who took part in the discussion were Frank G. McCann, Conway Kiewitz, and Mr. Lindsay, all of the engineering department of the New York Board of Education, W. H. Driscoll, W. H. Carrier and J. I. Lyle. Mr. Lyle proposed the appointment of a committee to investigate the methods proposed of heating and ventilating the new school buildings. This was acted upon favorably and President Carrier appointed Messrs. Driscoll, Riley and McKiever to serve on the committee.

J. E. Bolling, chairman of the Guide Publication Committee, announced that 118 pages of advertisements had been secured to date, for the 1923 Guide. In this total, he said, were 24 new advertisers.

Pipe Welding in District Heating Work Discussed by Western New York Chapter.

G. B. Nichols, who was associated with Henry R. Kent & Company in connection with the installation of the central heating system at Cornell University, was the principal speaker at the February meeting of the Western New York Chapter, held February 5 at the Hotel Iroquois. The meeting was preceded, as usual by a dinner, and was attended by over 70 members and guests.

Mr. Nichols's subject was "Group Heating and the Adaptability of Welded Pipe in District Heating Construction." He outlined the Cornell University installation which consists of several miles of underground pipe lines, all of steel and all with welded joints. The address was illustrated by lantern slides.

J. A. Donnelly also addressed the meeting on the subject of hot water pipe sizes for equal distribution of heat to radiators at different floor levels, with special reference to pipe sizes for gravity hot water circulation.

Hugo Hutzel, chairman of the Chapter Relations Committee, reported on the annual meeting of the society in Washington. It was suggested that each chapter assign one meeting for criticism of the A. S. & V. E. 1923 Guide, and another meeting to discuss the recirculation of air for ventilation.

O. K. Dyer outlined the reports presented by the Research Laboratory at the society's annual meeting. He told how representatives of the various chapters had agreed to raise the necessary funds for the continuation of the research work and asked that each member give his support when the request came for a contribution. He stated that Edgar Wendt had underwritten $1,500 required to be raised by the Western New York Chapter.

Philadelphia Chapter.

A continuation of the discussion of the January subjects was the feature of the Philadelphia Chapter's February meeting, held February 8 at the Engineers' Club, Philadelphia. The two subjects considered were "Two-Pipe Gravity Steam System for a Residence," which was presented by R. V. Frost and "Hot Water System for a Residence," by L. E. Moody. The same building outline was used for both of these papers and a lively discussion followed the presentation of each.

The following officers were nominated for 1923-1924: President, Thornton Lewis; vice-president, Ramon C. Bolsinger; treasurer, Alexander McClintock, Sr.; secretary, H. B. Hedges. Board of Governors: Frederick D. Mensing, George A. Eagan, Robert P. Schoenijohn. The annual meeting of the chapter will be held in March.

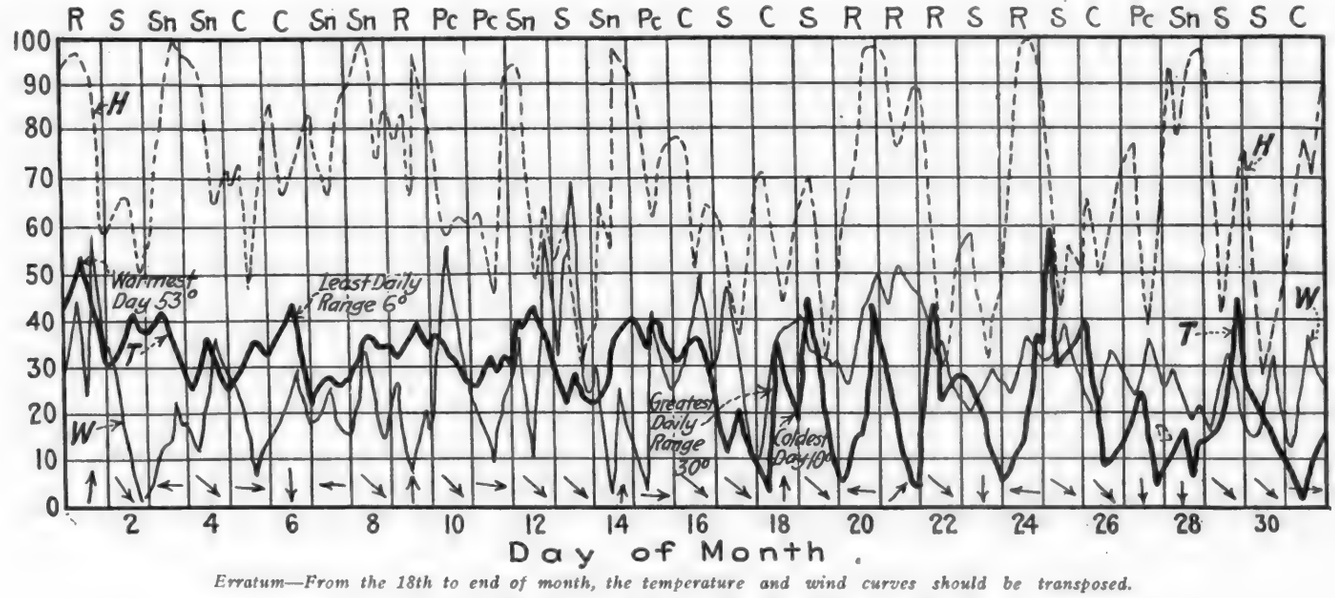
Kansas City Chapter.

Edwin S. Hallett, chief engineer of the St. Louis Board of Education, was the principal speaker at the February meeting of the Kansas City Chapter, his subject being "Evolution of Heating and Ventilation in School Buildings." Mr. Hallett laid particular stress on the successful use of ozone and air washers in the ventilation of the St. Louis schools. H. P. Hitchcock was the chairman for the evening.

American Engineering Standards Committee, whose machinery during the last four years has been the accepted medium for national standardization of raw materials, industrial processes and manufactured products in the engineering field, has undertaken the standardization of abbreviations and of the symbols used in engineering equations and formulas. This action was taken in response to requests received from the American Institute of Electrical Engineers, American Society of Mechanical Engineers and the Association of Edison Illuminating Companies. The first conference was held February 13 in the Board Room of the A. S. M. E.

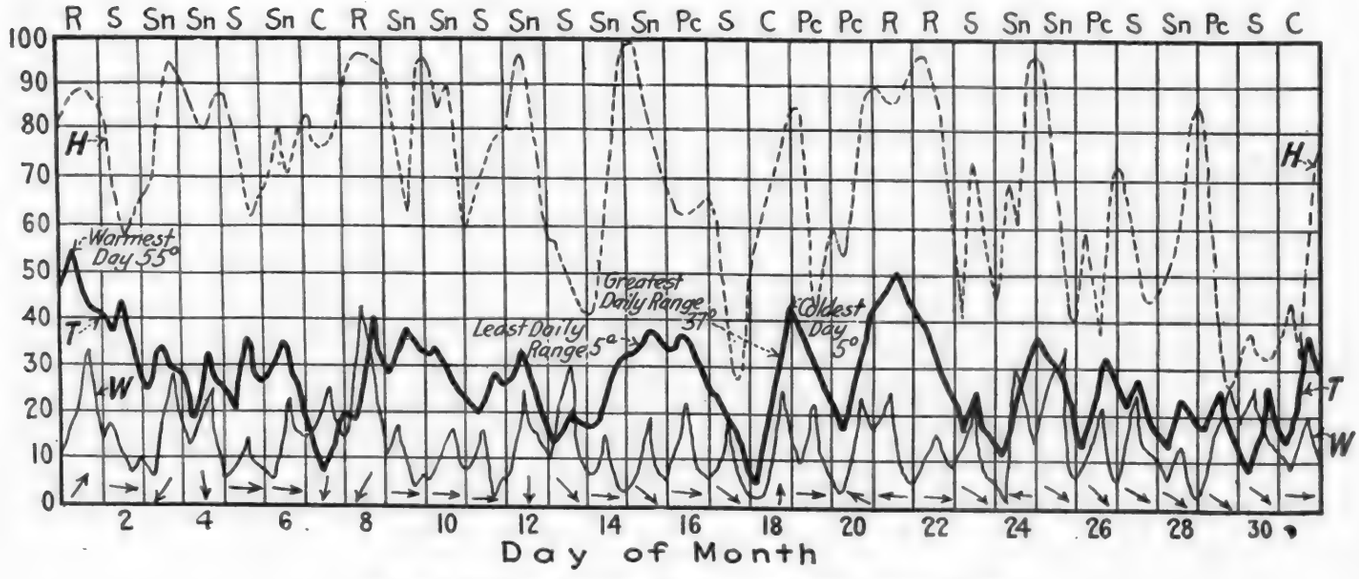
The Weather for January, 1923

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	53	55	55	49	62
Date of highest temperature	1	1	18	18	18
Lowest temperature, deg. F.	10	5	11	11	24
Date of lowest temperature	18	18	17	10	6
Greatest daily range, deg. F.	30	37	32	23	25
Date of greatest daily range	18	18	18	17	8
Least daily range, deg. F.	6	5	4	4	6
Date of least daily range	7	15	15	6	3
Mean temperature for month, deg. F.	31	27	33.4	30.8	39.5
Normal mean temp. for month, deg. F.	30.9	27.8	30.5	25.1	30.8
Total precipitation, in	7.97	6.08	3.5	0.92	2.08
Total snowfall, in.	21.8	28	2.9	4.4	0
Normal precipitation for month, in.	3.79	3.82	2.87	2.00	2.27
Total wind movement, miles	14756	8596	9625	9140	10710
Prevailing wind direction	N. W.	N. W.	W.	W.	S.
Number of clear days	5.	8	1	5	5
Number of partly cloudy days	10	5	3	9	11
Number of cloudy days	16	18	27	17	15
Number of days with precipitation	15	16	15	15	8
Number of days with snow	11	14	7	8	0
Snow on ground at end of month, in.	1.5	7.6	0	0	0

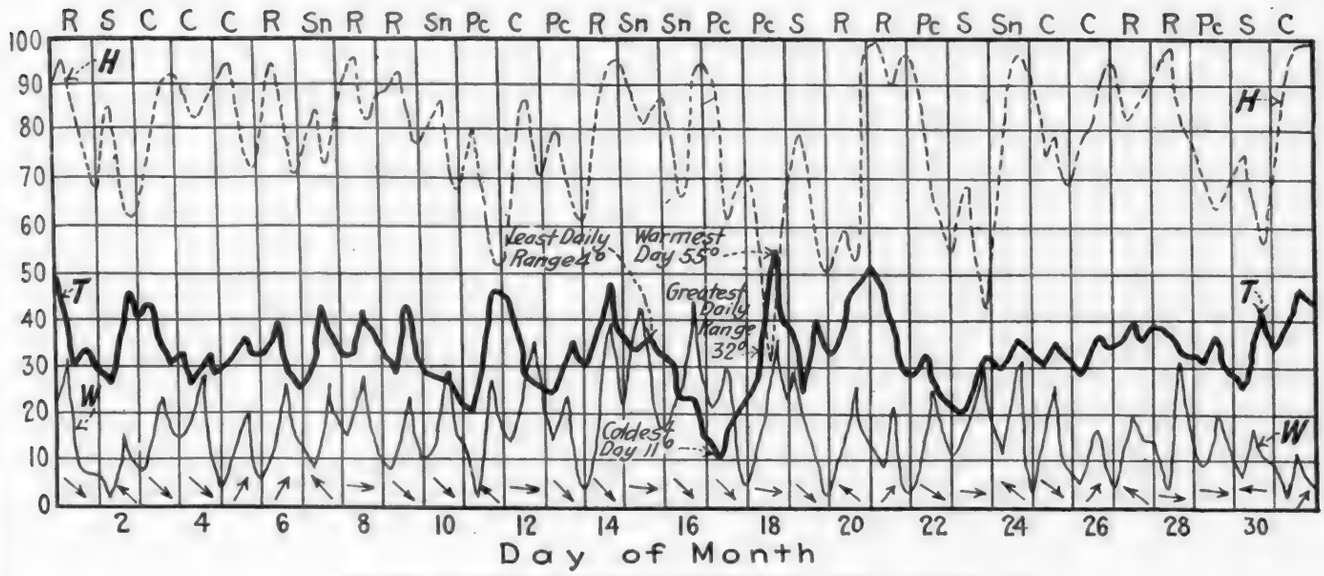


Erratum—From the 18th to end of month, the temperature and wind curves should be transposed.

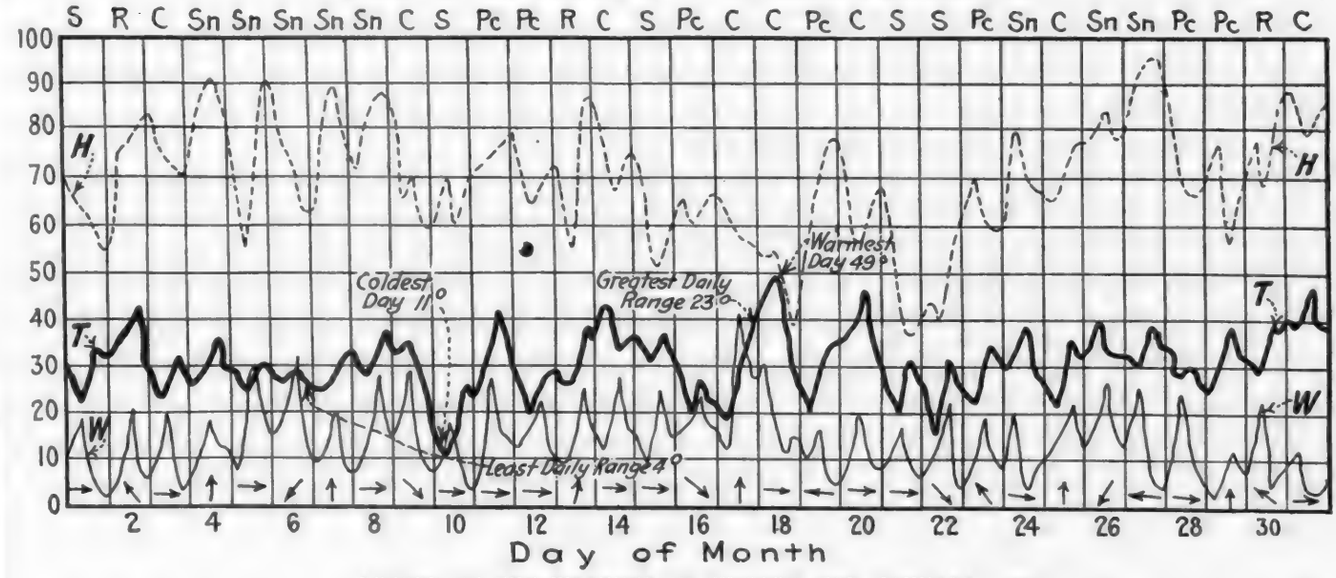
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY, 1923,
(Hourly Observations of Relative Humidity Plotted on this Chart.)



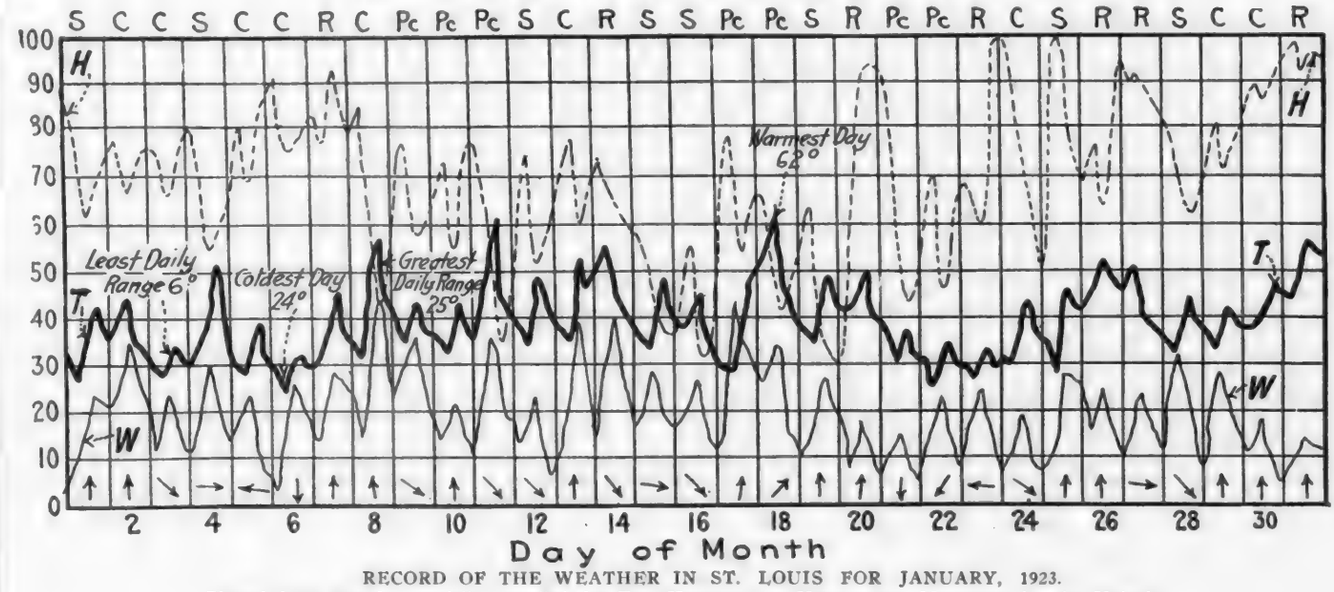
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1923.


R S C C C R Sn R R Sn Pc C Pc R Sn Sn Pc Pc S R R Pc S Sn C C R R Pc S C
H
T
W
Least Daily Range 4°
Warmest Day 55°
Greatest Daily Range 32°
Coldest Day 11°
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY, 1923.


S R C Sn Sn Sn Sn Sn C S Pc Pc R C S Pc C C Pc C S S Pc Sn C Sn Sn Pc Pc R C
H
T
W
Coldest Day 11°
Greatest Daily Range 23°
Warmest Day 49°
Least Daily Range 4°
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1923.


S C C S C C R C Pc Pc Pc S C R S S Pc Pc S R Pc Pc R C S R R S C C R
H
T
W
Warmest Day 62°
Least Daily Range 6°
Coldest Day 24°
Greatest Daily Range 25°
100 90 80 70 60 50 40 30 20 10 0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1923.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing directions of wind.

National Trade Extension Bureau

A National Apprenticeship Program

A much-needed work has been done by the apprenticeship department of the National Trade Extension Bureau, in conjunction with the Apprenticeship Committee of the National Association of Master Plumbers, in preparing a national apprenticeship program for the heating and plumbing industries. This program is now available in booklet form, at $1.25 a copy.

In the introduction, written by R. E. Maloney, of the National Trade Extension Bureau, attention is called to the fact that "in recent years there has been a tendency on the part of society to ignore or at least to be uninterested in the 'overall phases' of life." The direct result of this attitude, it is pointed out, is that fewer boys have entered the skilled trades. At the present writing there is a serious shortage of competent skilled workman in the building trades.

"Society must realize," continues Mr. Maloney, "that for any civilization to progress there must be advancement in all essential branches of that civilization. Construction is an essential branch of civilization, for civilization first began when primitive man settled in one place and made himself a permanent shelter. Our judgment of the civilization, refinement and culture of each age is based upon the buildings it has left as monuments."

The first step in the study of this problem was to compile exact labor statistics to find out exactly what the existing conditions were. This was done and the fact has been brought out that there is only one apprentice to each 6.8 journeymen. Holding the same low proportion of apprentices to journeymen and requiring a five-year term of apprenticeship means that it would take 34 years to train enough men to replace the present number of skilled steam fitters and plumbers.

The course of procedure adopted to relieve the situation is to establish and efficiently operate an apprenticeship system, although care will be taken not to provide a supply of cheap labor for the employer or to create an over-supply of workman. The supervisory and executive power for carrying out the purpose of this plan is vested in the National Apprenticeship Committee. The specific establishment, operation and control, and regulation of standards and of all educational work for apprentices in the heating and plumbing trades in each city or district, will be in the hands of the local apprenticeship committee of the heating contractors' or master plumbers' association, as the case may be.

IMPORTANCE OF SECURING RIGHT KIND OF BOYS.

The committee's first step in the solution of the problem is the securing of the right kind of boys. To aid in attracting boys, the National Trade Extension Bureau has composed a "Help Wanted" advertisement, which will be supplemented by "Help Wanted" posters. In addition, a booklet has been prepared for general distribution entitled, "A Business Future for American Boys."

By placing these booklets and posters in the schools between January and June, it is believed that a sufficient number of boys will be secured in each locality to enable the local apprenticeship committee to make a selection of those best fitted for these particular trades.

WAGES FOR APPRENTICES.

On account of the varying wage scales in different parts of the country, it is impossible to set up any standard wage for apprentices. It is recommended, however, that the wage scale should be in direct ratio with the wages paid journeymen in a given locality. The committee suggests the following minimum wage scale for apprentices:

The first six months, 23% of the journeymen's wage.

The second six months, 27% of the journeymen's wage.

The second year, 33⅓% of the journeymen's wage.

The third year, 50% of the journeymen's wage.

The fourth year, 66⅔% of the journeymen's wage.

The fifth year, standard journeymen's wage.

A STANDARD OF KNOWLEDGE THE REAL REQUIREMENT.

In connection with the period of service, the committee believes that the prevailing practice of considering a five-year period of apprenticeship as the only qualification necessary for a boy to become a journeymen is entirely wrong. The real requirement, it is felt, should be a standard of knowledge of the theoretical and practice side of all departments of these trades. The fundamental question, it is maintained, is what the journeyman knows and not how long it took him to acquire this knowledge.

The committee therefore recommends that the basic apprenticeship term be set at four years of approximately 2400 hours each, with advanced standing allowed (through examination) to graduates of high, technical or vocational schools.

ESTABLISHING OF SCHOOLS.

Inasmuch as the public schools are designed and equipped to give the necessary part-time instruction to apprentices, the local apprenticeship committee, it is urged, should endeavor to interest the public continuance of evening school system. The public school vocational directors, it has been learned, are glad to cooperate. The first step for the committee is to get in touch with the superintendent of schools who will assign the work to the local vocational director. Where this is impossible the matter should be taken up with the State Supervisor of Industrial Education.

Usually all that is needed, states the report, to gain the cooperation of the local vocational director is an active interest in the apprenticeship development. But where such cooperation cannot be obtained the local committee should use other existing facilities or open their own schools with educators of their own choice. It is believed, however, that there will seldom be an occasion where the opening of a private school will be necessary.

The part-time school is particularly recommended where the boy is allowed a certain number of hours each week, or during the dull season of the year, from his work, to attend class. This type of class is recommended for the reason that the apprentices are usually growing boys who have put in eight hours of honest work as apprentices, and then attend evening schools which takes another four hours daily, 2½ hours in the evening school and 1½ hours in going and coming from school. It is sometimes possible to arrange for a part-time class to meet on one afternoon of the week on the employers' time, and on Saturday afternoon, which is usually on the boy's time. In this way, while there are eight class hours a week, only one-half of the time used for class work is on the employer's time.

Where it is not possible to arrange part-time classes, then the best substitute is the class in the evening school. The report recommends not less than two evenings a week (two hours each evening) of these classes, preferably one evening a week on trade subjects and practice and one evening a week on related subjects or supplementary work.

Included in the report are a number of suggested courses of study together with photographs of the school equipment and class work at the Boys' Technical High School, in Milwaukee, Wis.

The booklet concludes with suggested apprenticeship forms, form of application blank, and forms of diplomas.

Home Heating in California Differs from That of East.

Some of the principal differences that obtain in California house-heating practice, as compared with that of the Eastern sections of the country, are pointed out by Myron Hunt, past vice-president of the Los Angeles Chapter, American Association of Engineers, writing in the Los Angeles *Examiner*.

"California building conditions," says Mr. Hunt, "are different from building conditions in the East and in the North.

"The distinctive quality of the California residence results from the climate.

"Slowly we are developing something which our Eastern friends recognize as

California, particularly in our residence architecture.

"It is not necessary with us to begin by digging 5 or 7 ft. in the ground in order to get below the frost limit for the foundations.

"One of the resulting differences between a California house and a typical house in a cold climate is the inclination on the part of the Californian to let his house spread out because his heating problem is so simple in comparison with the problem of zero weather countries, that he is able to do what is recognizable everywhere when we see our California bungalows and other small residence structures.

"Their characteristic is that they are not square, vertical boxes with a second story superimposed immediately above the first story, with the prime object of conserving the heat of the first story and allowing it to sift up into and help heat the second story.

"On the other hand, it is quite necessary for us to do everything that we can to make our houses cool and wherever methods are followed which will make our houses cool in summer, those same types of good construction which tend toward this coolness also tend toward the conservation of the warmth obtained from artificial heating during such cold weather as we may have.

"Another one of our California problems in the matter of heating a house, large or small, is that we need heat for two or three hours in the morning at certain seasons of the year when no heat is needed for the rest of the day or at all events not until evening comes again.

"For these various reasons the methods of heating residences which have been developed in the East have needed to be modified in developing a logical heating system for California.

"We spend so much time outdoors that if it is possible to heat a bedroom or a dressing room or a bathroom and then to heat a dining room until after breakfast time it is quite possible to get along without any heat at all in the balance of the house for the rest of the day, most days of the year except perhaps for the heating of a living room for a short time in the evening.

"The same thing applies in a lesser degree, especially in small buildings, to the use of steam. What we have developed is the gas radiator, the gas fireplace and the unit furnace which takes care of one room or two rooms.

"The necessity for quick heat in small units of the house instead of constant heat throughout the house and throughout the day has developed in California a special series of heating methods intended to fill these requirements.

"The installation of unit heaters in rooms or in basements for separate rooms has come to be the accepted method.

"For instance, the best method of heating that has ever been evolved—that by hot water—is seldom used in California because its best quality in a cold climate becomes its unfortunate quality in California. That quality is the ability of a hot water radiator to hold and radiate its heat for a considerable time.

"When we want to turn the heat off in a room in California we want to turn it off and so there is less hot water heating done in California than anywhere else in the country.

"The gas radiator exists in a dozen forms and many of them are satisfactory. Care should be taken to make certain that the foul air of combustion is never allowed to escape into the room and wherever it is possible to do so, care should be taken to draw the air that is to be used in combustion from outdoors.

"This double arrangement is less easily accomplished with a gas radiator than with what are known as unit furnaces. These furnaces can be located in the basement.

"If the air in the basement is fresh and clean they can take this fresh air from the basement, heat it and pump it into the room, assuring a supply of fresh and warmed air rather than the reheating of the old air.

"One of the most interesting developments in connection with these unit heaters is upon the electric side, which makes it possible to turn these heaters on by touching a buttom as you would turn on an electric light in entering a room and a by-product of this development has been the little red pilot light which tells when you enter a room whether the register for that room, or rather the unit heater for that room, is working or not.

"Another further development and refinement of this system is the means by which at one central point in the house a group of these little red lights tells you exactly how many and just which ones of some two or three or even five little furnaces in the basement are working and which rooms they are supplying air to.

"It is, therefore, possible to shut off all the heat in the house from one central point upon going to bed."

1923—A Five Billion Dollar Building Year.

With figures based on reports obtained from 1767 architects covering projects in process of planning for 1923, the *Architecural Forum* has announced the result of its annual building survey and forecast which indicates that the investment in new buildings in 1923 will be a billion dollars greater than in 1922.

The figures in the accompanying table were arrived at by taking the actual reports from the offices of 1767 architects and multiplying these totals by 3.1. This index figure has been determined by a comparison of the reporting offices with all architectural offices as to volume and classification of work from data maintained in each architectural office in the country.

This information, together with comparative percentages of construction work not controlled by architects as indicated, and the assumption of the index figure 3.1 has been proved reasonably accurate by actual construction figures in connection with previous surveys.

VOLUME OF BUILDING INDICATED FOR 1923.

BUILDING TYPES	N EASTERN STATES	N ATLANTIC STATES	S. EASTERN STATES	S. WESTERN STATES	MIDDLE STATES	WESTERN STATES	U. S. A
Dwellings (Under $20,000)	$16,622,000	$86,465,000	$12,825,000	$12,084,000	$59,160,000	$34,925,000	$222,081,000
" ($20,000 to $50,000)	11,668,000	41,828,000	8,587,000	10,552,000	33,468,000	12,757,000	118,860,000
" (Over $50,000)	6,045,000	27,481,000	2,031,000	6,113,000	21,077,000	10,444,000	73,191,000
Apartments	56,020,000	237,296,000	25,392,000	34,323,000	229,552,000	80,302,000	662,885,000
Hotels	33,589,000	141,146,000	27,683,000	40,765,000	205,332,000	60,475,000	508,989,000
Clubs, Fraternal, etc.	15,888,000	58,221,000	13,268,000	28,784,000	109,700,000	50,406,000	276,266,000
Churches	17,577,000	128,120,000	15,128,000	25,519,000	82,903,000	43,688,000	312,936,000
Community, Memorial	14,620,000	27,401,000	1,950,000	6,209,000	46,509,000	21,099,000	117,788,000
Welfare, Y.M.C.A., etc.	3,295,000	15,702,000	2,576,000	3,302,000	15,680,000	9,688,000	50,242,000
Hospitals	13,594,000	54,166,000	6,972,000	27,438,000	105,096,000	52,148,000	259,414,000
Office Bldgs.	21,157,000	88,877,000	18,089,000	26,159,000	190,486,000	82,603,000	427,570,000
Banks	17,608,000	54,328,000	8,835,000	18,783,000	154,482,000	38,669,000	292,705,000
Schools, Public Bldgs.	65,159,000	158,165,000	41,515,000	31,930,000	383,036,000	190,228,000	870,034,000
Theatres	9,573,000	34,847,000	2,759,000	7,381,000	29,388,000	17,943,000	101,891,000
Stores	11,113,000	35,383,000	6,826,000	7,480,000	58,361,000	27,723,000	146,887,000
Industrial	29,859,000	162,762,000	38,824,000	25,231,000	241,871,000	49,488,000	548,037,000
Automotive	11,988,000	35,942,000	2,799,000	8,386,000	52,464,000	15,190,000	126,768,000
Total Value of New Buildings	$355,375,000	$1,388,130,000	$236,059,000	$320,639,000	$2,018,565,000	$797,776,000	$5,116,544,000

Artesian Wells Yield Hot Water.

The present fuel shortage holds few terrors for residents of Boise, Idaho, for they are supplied with natural heat from hot water artesian wells near the city, states a writer in Popular Science Monthly. The wells, which have a capacity of 1,500,000 gal. a day, supply enough water at 170° F. not only to meet the needs of the natatorium, but also to heat hundreds of homes and office buildings in the vicinity.

Two 6-in. wells were drilled originally to supply heated water for the pool. There was found to be a surplus, however, and pipe lines were extended to the heating systems of nearby homes. A 5/16-in. feed pipe, brings a yearly rental of $160. At that rate tenants are supplied with hot water for all kitchen, bath and heating purposes and receive the free service of the heating company for cleaning, waste removal and reasonable repairs.

A larger service line is used for connection to Boise office buildings.

Portable Unit Ventilators

3—The Buckeye Heatovent.

One of the most recent types of portable unit ventilators to attain prominence in the heating and ventilating field is the Buckeye Heatovent, manufactured by the Buckeye Blower Co., Columbus. In the design of the Heatovent a cabinet of attractive design is used to enclose a steam coil and a pair of small, slow-speed multiblade fans. These fans serve to draw in fresh air from out-of-doors through a pipe coil heater contained within the cabinet. The warmed air is then discharged from the cabinet into the room through small louvre openings at the top of the cabinet across the front and ends. The final temperature of the air is regulated by a balanced mixing damper in the air intake which acts to direct all or part of the air through the heater, allowing the balance to by-pass directly to the fans.

The blades of the mixing damper are mounted in brass bushings and the damper placed in static balance so that it will respond instantly to the action of a graduated thermostat, when the room is controlled by automatic regulation.

Each unit is equipped with a special slow-speed 40° C. electric motor on an insulated base on top of the heater structure. A multiblade wheel is keyed to each end of the motor shaft.

In order to avoid a magnetic hum from being transmitted through the casing, the rotating parts are mounted entirely independent of the casing on the solid structure of the steel heater. Care is also taken to place the rotating parts in dynamic balance by running the motor assembly at full speed on a light spring testing platform, after the wheels are fitted on the motor shaft. In this way, it is stated, the slightest vibration can be detected. The behavior of the units tested according to this method lead the manufacturers to state that the Heatovent is entirely free from vibration.

The motors are fitted with phosphor bronze bearings of ample size to carry the combined load of motor armature and fan wheels. Standard motors are wound for 115 volts D. C. A motor rheostat is used to regulate the speed of the fans, reducing the air volume from the maximum rating to the requirements of the room being ventilated.

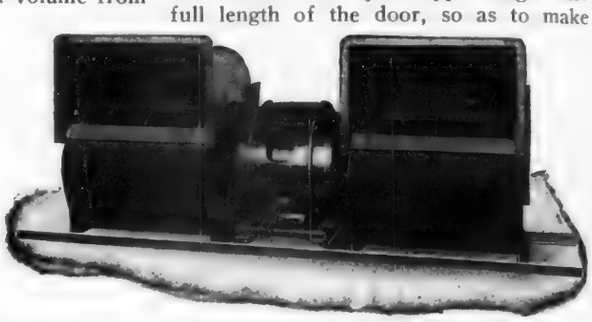
Care has been taken to design the fans to handle a large volume of air at slow speed and low pressure. To make the wheels as quiet as possible in operation, the blades are die formed and held in a jig as they are welded the wheel. Each half wheen is formed separately and mounted on the central aluminum disc, because these short half-length blades make a stronger and more rigid wheel than one long continuous blade.

The heater is a special steam pipe coil radiator, manufactured in the company's factory.

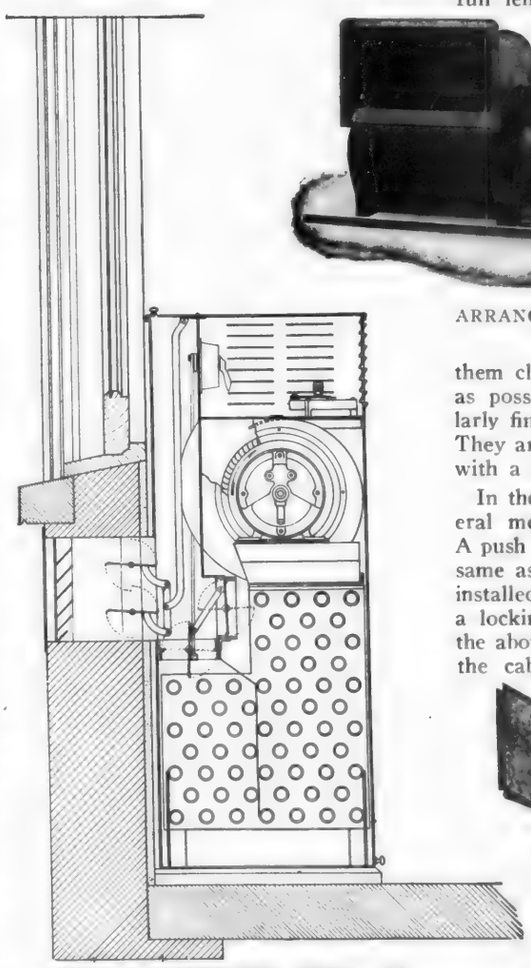
In connection with the fresh-air intake a set of movable louvres is arranged to automatically close the fresh-air intake when the recirculating door in the cabinet is opened. These louvres are mounted in brass bushings, to insure free operation and to eliminate the chance of rusting or binding. The fresh-air intake itself is protected by a 1¼-in. diamond mesh wire grille back of which are placed weatherproof storm louvres.

Special emphasis is laid by the manufacturers on the construction and appearance of the Heatovent cabinet. It is built of No. 12 and No. 14 gauge stretcher-leveled furniture steel, without sharp corners or raw edges. All doors are mounted on piano-type hinges the full length of the door, so as to make them close fitting and as nearly air tight as possible. Types C and D are regularly finished with seven coats of enamel. They are regularly finished in olive green with a narrow gold striping.

In the operation of the Heatovent, several methods of control may be used: A push button or flush tumbler switch, the same as used on lighting fixtures, can be installed in the wall near the Heatovent; a locking switch may be substituted for the above; a snap switch may be laced in the cabinet and cabinet locked; or all

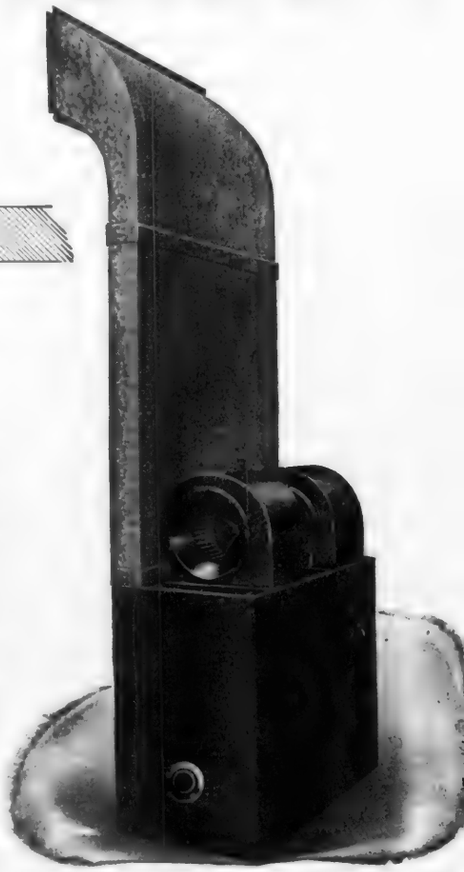


ARRANGEMENT OF HEATOVENT FAN UNITS AND MOTOR.



TYPE C HEATOVENT WITH AIR INTAKE UNDER WINDOW

THE BUCKEYE HEATOVENT.



TYPE A HEATOVENT FOR INTRODUCING AIR AT HIGH LEVEL

Room Temperature 70 degrees Fahr. Steam at Zero pounds gauge pressure.

Unit No.	Cu. Ft. Air per min.	Entering Air -10 F.			Entering Air Zero F			Entering Air +10 F.			Entering Air +20 F.		
		Final Temp.	Cond. lbs per hour	Omit Sq. Ft. Rad.	Final Temp.	Cond. lbs per hour	Omit Sq. Ft. Rad.	Final Temp.	Cond. lbs per hour	Omit Sq. Ft. Rad.	Final Temp.	Cond. lbs per hour	Omit Sq. Ft. Rad.
36	750	68	76	Add 6	73	70	10	78	64	26	84	59	44
37		82	90	Omit 38	88	84	56	91	76	66	96	70	81
38*		94	101	" 75	98	94	85	102	86	100	106	78	114
46	1000	68	102	Add 8	73	93	13	78	85	34	84	78	50
47		82	120	Omit 50	88	112	75	91	101	88	96	93	108
48*		94	135	" 100	98	125	114	102	115	134	106	105	152
56	1250	68	127	Add 10	73	116	16	78	106	42	84	98	74
57		82	150	Omit 63	88	140	94	91	126	110	96	116	135
58*		94	169	" 125	98	156	142	102	144	167	106	131	190
66	1500	68	153	Add 12	73	140	20	78	128	53	84	118	89
67		82	180	Omit 75	88	168	112	91	152	132	96	140	162
68*		94	202	" 150	98	188	170	102	172	201	106	158	228

* Type D Heatovents only.

Room Temperature 70 degrees Fahr. Steam at five pounds gauge pressure.

Unit No.	Cu. Ft. air per min.	Entering Air -10 F.			Entering Air Zero F			Entering Air +10 F.			Entering Air +20 F.		
		Final Temp.	Cond. lbs. per hour	Omit Sq. Ft. Rad.	Final Temp.	Cond. lbs. per hour	Omit Sq. Ft. Rad.	Final Temp.	Cond. lbs. per hour	Omit Sq. Ft. Rad.	Final Temp.	Cond. lbs. per hour	Omit Sq. Ft. Rad.
36	750	74	82	13	80	77	31	85	71	47	90	65	63
37		90	97	63	95	91	78	99	84	92	104	77	106
38*		104	111	106	107	101	117	111	95	132	115	87	142
46	1000	74	110	17	80	102	42	85	94	63	90	86	84
47		90	130	84	95	121	104	99	112	122	104	103	142
48*		104	148	142	107	135	156	111	126	176	115	116	190
56	1250	74	138	21	80	128	52	85	118	78	90	108	105
57		90	163	105	95	152	130	99	140	152	104	129	177
58*		104	185	177	107	169	195	111	158	220	115	145	237
66	1500	74	156	25	80	153	63	85	141	94	90	129	126
67		90	195	126	95	182	156	99	168	182	104	155	198
68*		104	222	213	107	203	234	111	189	264	115	174	285

*Type D Heatovents only.

switches may be located on a central panel board in the basement. All but the first method will prevent any unauthorized tampering.

While for ordinary use the Heatovent is most easily installed as shown in Fig 4, the units may also be arranged to meet the requirements of those building codes which require the air to be introduced into the room through a wall register 8 ft. above the floor. In such cases the Heatovent is installed in a niche in the wall and the air is discharged through a stack and register face located as required.

With this arrangement the exhaust system is the same as if a central fan system were installed; that is, a vent flue is provided in each room with a vent register equipped with aluminum back draft check dampers placed on the base of the flue.

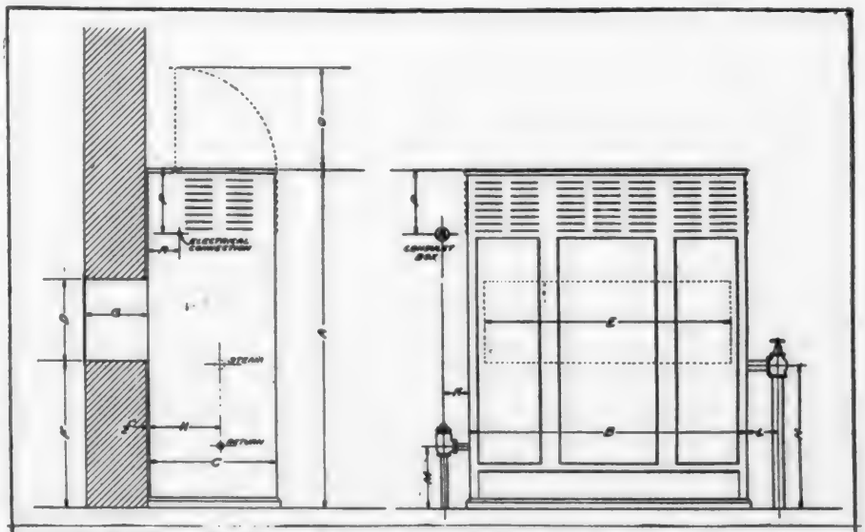
SAMPLING AND ANALYSIS OF COAL, COKE AND BY-PRODUCTS, which, as announced last month, has been published by the Chemists' Committee of the United States Steel Corporation, is the second edition of a former pamphlet, but the amount of matter which has been added makes it equivalent to an entirely new work. The book details the methods followed by the corporation's Chemists' Committee. Not only was the old material of the first pamphlet carefully re-edited and revised, but a great many methods and tests not covered by the former work are included in the new edition.

The work naturally divides itself into two parts, namely, one covering the sampling and analysis of coal and coke, and the other, the sampling and analysis of by-products. The first part embraces the sampling of coal and coke, physical tests on coal and coke, the proximate analysis of coal, determination of the calorific value of coal and coke and the determination of coke and by-products yields from coal.

The new features, not touched upon in the former work, embrace, among other things, details for sampling by-product coke, physical testing of coke, determination of the different forms of sulphur in coal, fusibility of coal and coke ash, and a method for calibrating thermometers. Bound in leather, 5 in. x 7¾ in. Pp. 200.

Fulton Company's Patent No. 905,465.

The Fulton Co., of Knoxville, Tenn., manufacturer of the Sylphon line of heating specialties, valves and temperature control apparatus, has issued a statement in connection with recent litigation over the validity of Fulton patent No. 905,465, to the effect that the decision of the District Judge of the Federal Court in Cincinnati and of the Federal Court of Appeals of the Sixth District, dismissing the company's suit for infringement, relates to but one of its patents covering the Sylphon metallic-bellows heating specialties. The company owns a large number of patents which, it is stated, protects it in its exclusive right to manufacture and sell these products.



Unit No	A	B	C	D	E	F	G	H	K	L	M	N	O	P	R	Steam	Return
36C	49¾	32	18⅝	9"	24	21" is minimum. 34" is maximum.	Varies according to width of Wall. 9" is minimum.	10½	3¾	4½	9¼	21	14½	12	5	1½"	1"
37C	49¾	32	18⅝	9"	24			10½	3¾	4½	5½	21	14½	12	5	1½"	1"
46C	49¾	40	18⅝	9"	32			10½	3¾	4½	9¼	21	14½	12	5	1½"	1"
47C	49¾	40	18⅝	9"	32			10½	3¾	4½	5½	21	14½	12	5	1½"	1"
56C	49¾	50	18⅝	12"	30			10½	3¾	4½	9¼	21	14½	12	5	2"	1¼"
57C	49¾	50	18⅝	12"	30			10½	3¾	4½	5½	21	14½	12	5	2"	1¼"
66C	49¾	60	18⅝	12"	36			10½	3¾	4½	9¼	21	14½	12	5	2"	1¼"
67C	49¾	60	18⅝	12"	36			10½	3¾	4½	5½	21	14½	12	5	2"	1¼"

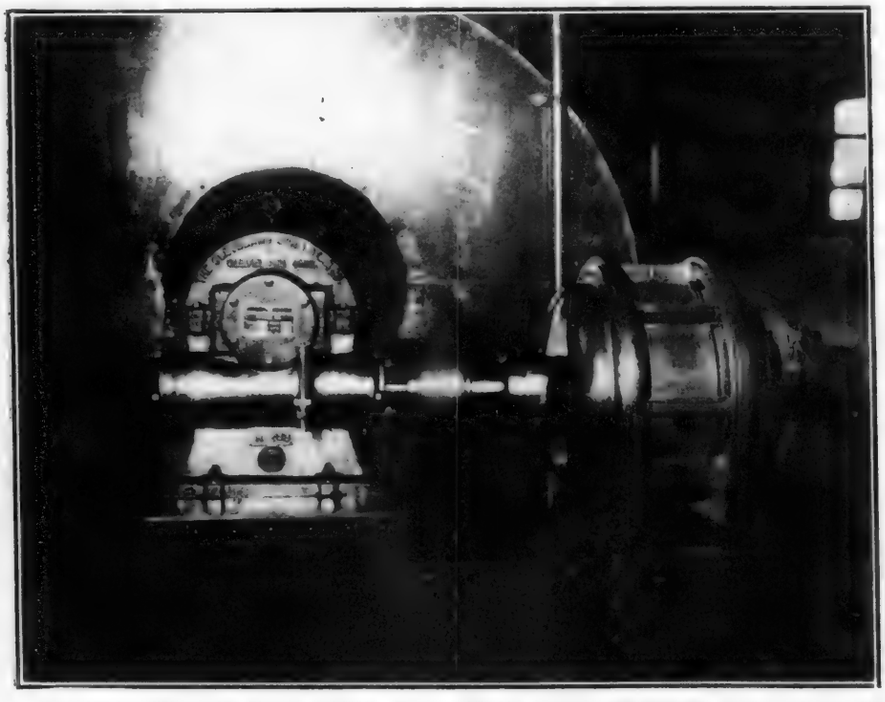
New Apparatus and Appliances

Worm-Gear Reduction Drives for Fans.

Since efficient and reliable worms and gears were developed for the rear-axle drive of motor trucks, the use of this type of gearing has spread to various industrial applications. For a ventilating fan, such as that shown in the illustration, a drive of this type has been found particularly suitable, inasmuch as silence and compactness are essential for installations of this character.

A well-made worm gear drive, it has been found, will run in continuous service at a high worm speed smoothly and quietly. The drive itself is very compact, while the right-angle feature, permitting the motor to be placed next to the fan, will often save additional space. On account of the ability of the worm to take large reductions, a high-speed motor may be used. This means a smaller and less expensive motor and, in case of induction motors, a better power factor.

These drives are mounted on ball bearings and run in oil. They are enclosed in dust-proof housings so that they do not require safety guards. The worm is made of heat-treated hardened and ground steel and the gear of a special analysis phosphor bronze. They are manufactured by the Cleveland Worm & Gear Co., Cleveland, O., and are also being featured as suitable for other equipment located in public buildings, such as pumps, compressors, elevators, conveyors, etc. The Cleveland Worm & Gear Company is rated as one of the largest manufacturers in the country of worms and gears for the motor truck industry.

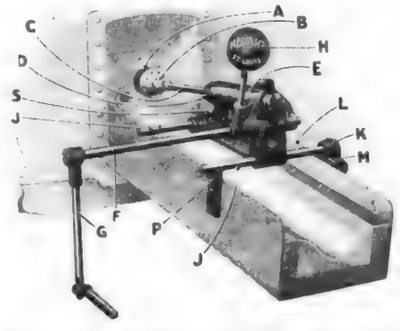


WORM-GEAR REDUCTION DRIVE APPLIED TO FAN.

Medart Safety Cupola Tapper and Stopper.

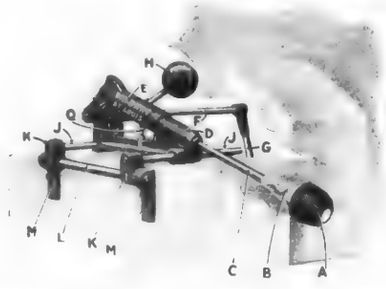
With the long-prevailing practice the cupola man has needed experience and skill to tap and stop the flow at just the proper instants, by means of the long, clay-tipped rod held in his hands. In this work any trivial accident, such as the falling of the tip of fire clay from the rod, the slipping of the rod or the forcing of the stop out of the cupola breast, may cause great damage. With long heats, too, it has been necessary to relieve the cupola tender from time to time.

To meet the objections stated, a new device has been designed by the Medart Co., St. Louis, Mo., known as the Medart safety cupola tapper and stopper. This device, it is stated, does not require any change in the existing foundry equipment or organization and can be readily attached to any cupola. It is designed to assure the efficient and uniform tapping and stopping of the cupola by a mechanical apparatus. For that reason the work does not require expert or carefully trained men.



MEDART CUPOLA TAPPER AND STOPPER IN OPEN POSITION.

A vital feature of the apparatus is a composition ball (A), with a bolt head in the center, which fits against the breast of the cupola when the flow is stopped. It is necessary to renew this ball after each four or six heats. The cost of the ball is 75 cents, which makes the expense of operation a nominal item.



MEDART CUPOLA TAPPER AND STOPPER IN CLOSED POSITION.

The Arco Water Regulator.

Convinced that combustion control through automatic manipulation of the dampers is as desirable on water heating systems as on low-pressure steam heating plants, the American Radiator Company has perfected a water regulator for this work which has some interesting features. It is known as the Arco water regulator.

Boiler manufacturers, it is pointed out, have never made it a practice to furnish damper regulators with low-pressure water heating boilers, as they do with low-pressure steam boilers. The reason for this, it is stated, is that until comparatively recently there has never been a dependable, low-priced regulator on the market.

The Arco water regulator is designed to bring the water in a heating system up to any desired temperature between 100°and 200° F. and keep it there. This is accomplished by moving the weights upon the arm. After the weights are once set, no further attention is required. Besides preventing overheating, the regulation of the water temperature is a fuel-saving proposition.

The regulator is made entirely of metal. It contains an expansive metallic bellows which acts as a diaphragm, operating the damper control levers. It can be installed on any boiler, new or old.

Another type, known as the Arco Junior water regulator, is intended to control the water temperature in the kitchen hot water tank.

B. G. Lamme Presented Joseph Sullivant Medal.

The many notable engineering achievements of Benjamin G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., were officially recognized by

his alma mater, Ohio State University, Friday, January 12, when the university presented to Mr. Lamme the Joseph Sullivant medal.

Mr. Lamme who was graduated from Ohio State in 1888, is the first person to receive the Joseph Sullivant medal, which will, in the future, be awarded once in every five years for "an admittedly notable achievement on the part of a son or daughter of the Ohio State University, whether that achievement be in the form of an important invention, discovery, contribution to science, the practical solution of a significant engineering, economic or agricultural problem, or the production of a valuable literary, artistic, historical, philosophical or other work."

New Publications

VALVE WORLD for February, 1923, issued by Crane Co., Chicago, Ill., contains the second issue of its supplement, "The Crane Business Survey." According to this survey, which is dated January 25, in the Eastern Zone, general business, credits and collections are fair to good, with building permits large at nearly all points. Business in the Southern Zone is reported as quite satisfactory. The same holds true of the Northern Zone, which includes St. Paul and Minneapolis. The Central Zone reports business and collections as "very satisfactory," while in the Western Zone general business is marked as "fair to good." Canada reports general business good and collections fair. The summary states that no reaction is indicated from the satisfactory conditions of a month ago. The issue itself contains, among other things an interesting illustrated article on the new water works plant at Rockford, Ill., by E. M. Faul.

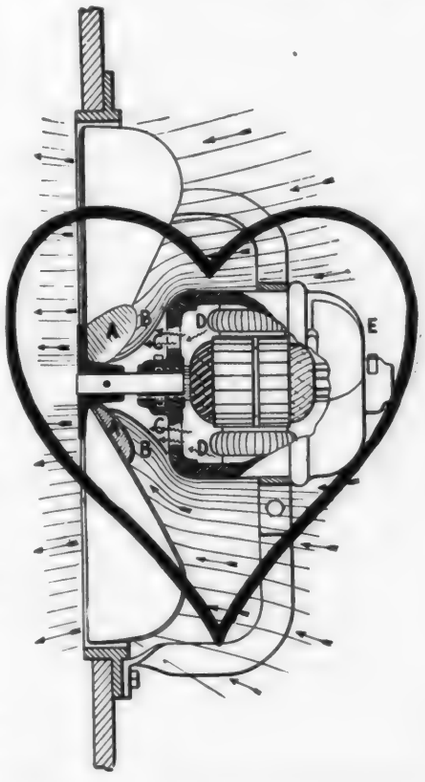
MIDWEST STEEL SECTIONS are illustrated and described in an architects' and engineers' data book, published by the Midwest Steel & Supply Co., 28 West 44th Street, New York. While the book is devoted largely to overhead shafting layouts, there is an interesting section on the use of the company's products for fastening pining in tunnels, supporting heavy piping to columns or walls in buildings, suspending heavy piping from the beams or girders of ceilings, and suspending a large number of lighter pipes from the ceiling, as in refrigerator plants. Size 8½ x 11 in. Pp. 56.

BRASS TACKS ABOUT BUSINESS is the title of an interesting broadside, published in the form of a newspaper by the Wm. H. Rankin Co., 180 North Wabash Ave., Chicago, Ill., advertising agents, and carrying the welcome headline "Prosperous 1923, Say All." The two inside pages are taken up with telegrams and letters from all sections of the country confirming the optimistic views expressed for 1923.

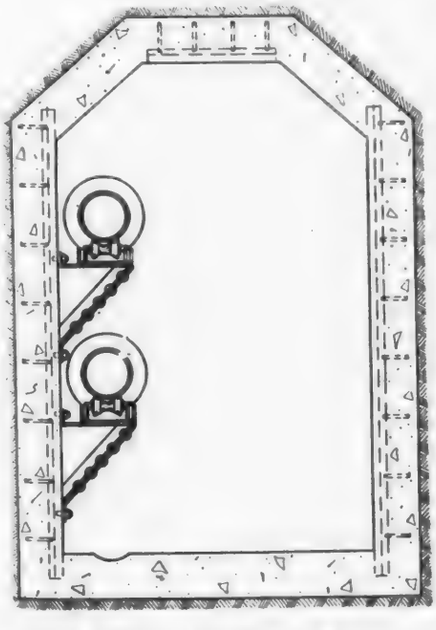
DE LAVAL SMALL SINGLE-STAGE CENTRIFUGAL PUMPS, TYPE F, for motor or belt drive, are the subject of a new catalogue issued by the De Laval Steam Turbin Co., Trenton, N. J. Accompanying the catalogue is a well-compiled instruction manual. These pumps are made in 1½ and 2 in. sizes, and are designed for capacities ranging from 5 gal. per minute against 10 ft. head up to 130 gal. per minute against 150 ft. head. They contain few simple parts, which are manufactured to limit gauges to insure interchangeability. The publications give very complete tables and instructions for selecting pumps for different conditions, and explain how to determine the proper speeds and how to select piping, valves, fittings, and driving pulley or motor to secure an efficient and satisfactory installation. Size 8½ by 11. Pp. 12 each.

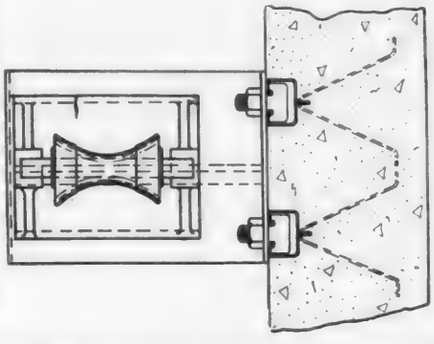
ARMCO INGOT IRON and its lasting qualities are brought to the attention of the trade through a newly-issued circular published by the American Rolling Mills Co., Middletown, O. An impressive illustration is shown of the ventilators in the roof of the Red Paper Conmpany's plant at Kalamazoo, Mich., manufactured from Armco ingot iron. Size 8½ x 11 in. Pp. 4.

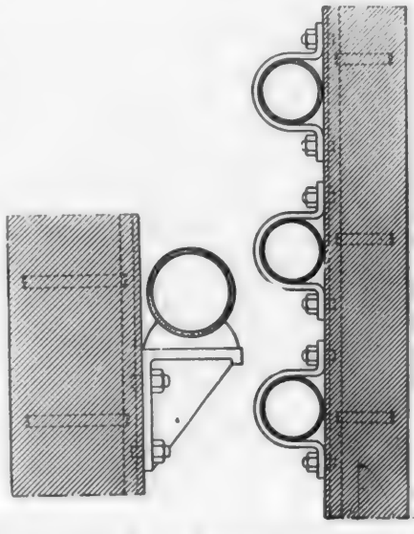
AUTOVENT PROPELLER FANS, radiation cooled, made by the Autovent Fan & Blower Co., Chicago, Ill., are presented in a new and concisely-arranged catalogue, giving the needed data for both direct current and alternating current fans. The company's line includes sizes from 12-in. to 72-in. direct current, sizes 12-in. to 36-in. A. C., single phase, and from 18-in. to 72-in. for A. C. multiphase. A handy dimension table is included as well as data on Autovent louvres. A lever idea is expressed in an illustration of a heart imprinted over the unit and carrying the caption, "The Autovent Fan Has a Heart." Another circular issued by the company is devoted to the Autovent Window ventil-



THE "HEART" OF THE AUTOVENT PROPELLER FAN.





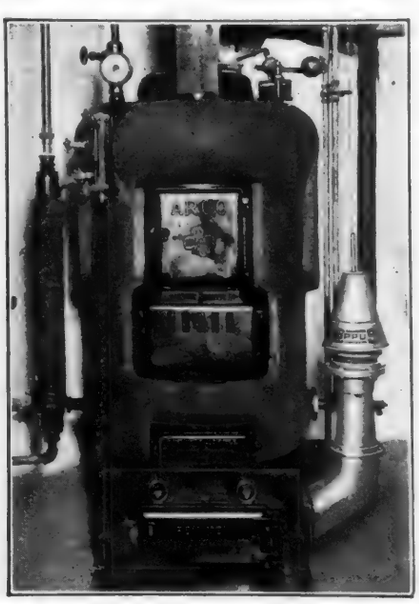


USE OF MIDWEST BOX RAILS AND BOX RAIL BOLTS FOR FASTENING PIPING IN PIPE TUNNELS, TO WALLS AND COLUMNS.

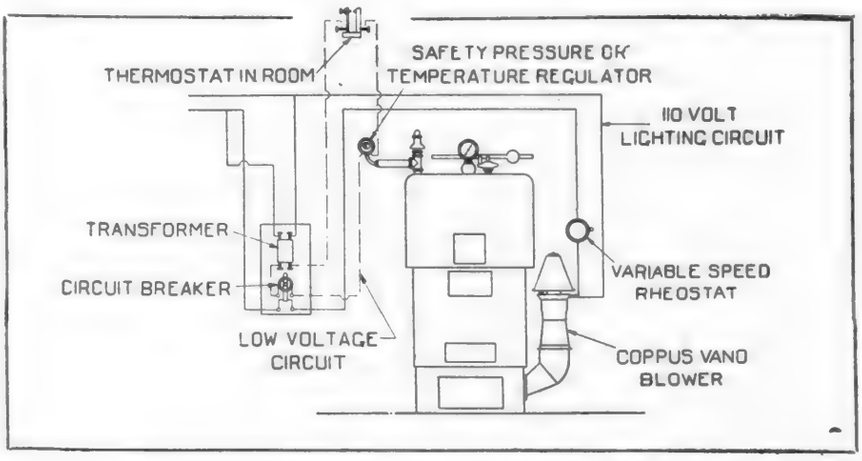
ator, for residence kitchen, home and office ventilation. Attention is called by the company to the fact that this ventilator is equipped with a regular standard power motor, designed and constructed for continuous duty and of the Autovent protected type; to prevent breaking down or burning out. It connects to an ordinary light socket and its cost of operation is given as less than one cent per hour. The Autovent window ventilator is furnished for direct or alternating current, three sizes being available in each type.

WALWORTH LOG for February, 1923, the periodical of the Walworth Mfg. Co., Boston, Mass., contains details of the formation of the Walworth Ohio Company which succeeds the old Hiram Rivitz Company, of Cleveland. The new company has a main store in Cleveland, with branches at West 65th Street, Cleveland, and Youngstown, together with a warehouse and pipe shop at East 40th Street, Cleveland, and another pipe storage warehouse across the way. In addition to views of the new plant, portraits are included of S. R. Mitchell, vice-president and general manager of the new Walworth unit; William N. Mickeborough, assistant treasurer, and of Hiram S. Rivitz, who is retiring from the jobbing field. The new company will take over immediately from the western division of the Walworth Mfg. Company substantially all the territory in Ohio and Western Pennsylvania.

COPPUS VANO BLOWERS, described as particularly suited for house heaters because of their small size for a given capacity and their unusual feature that the motors which drive them cannot be overloaded, are presented in a new circular published by the Coppus Engineering Corporation, Worcester, Mass. The circular is timed to suggest a relief in connection with the coal situation, as this apparatus is designed to enable a hard coal heater to burn soft coal, coke, screenings and even rubbish. As will be noted from the illustration, the blower, which acts as a blacksmith's bellows in furnishing a steady flow of air to the ashpit, stands vertically on top of a cast-iron elbow which is bolted to the ashpit shell. It is driven by a motor protected by a funnel-shaped hood which may be lowered, shutting off the blower inlet and thus acting as a damper when desired. The motor takes its current from the lighting circuit and a variable-speed rheostat is used to control the speed of the blower. In addition, each blower is furnished with an electrically-controlled thermostat operating a steam pressure or temperature regulator. This acts to stop and start the motor as conditions require. Size 3¼ x 6 in. Pp. 8.



COPPUS VANO BLOWER ATTACHED TO BOILER.



TYPICAL INSTALLATION OF COPPUS VANO BLOWER, SHOWING CONTROL ARRANGEMENT.

"ELECTRO" STEAM BOILERS, an apparatus for generating steam in any required quantity at any specified pressure by means of alternating current which is led directly into the water to be evaporated, are brought to the attention of the industry in a new catalogue published by the manufacturer, the Electro Furnace Construction Co., 908 Chestnut St., Philadelphia, Pa. The "Electro" steam boiler, an illustration of which appeared in THE HEATING AND VENTILATING MAGAZINE for June, 1922, is the result of several years' tests and experiments by F. T. Kaelin, chief engineer of the Shawinigan Water & Power Co., Canada, and has been devel-

WILLIAMSON INFORMATION BOOKLET on warm-air furnace installation, which was issued in June of last year by the Williamson Heater Co., Cincinnati, O., is now supplemented by some new matter intended to replace a portion of the original booklet. "Since the completion of the booklet," states the company, "the Standard Code Regulating the Installation of Warm-Air Furnaces in residences was improved and issued. The Standard Code is undoubtedly a most important step forward in the warm-air heating industry, but in order that we may take full advantge of the provisions of the code, they should be put into effect.

"The unit of estimation in warm-air heating is the square inch of piping. On this is based the size of furnace and the size of the cold-air or return connection. The Standard Code is very complete with rules for determining the size of pipe to be used, so that a great many points which were left to the estimator's judgment in the Information Booklet can be accurately determined from the Standard Code.

"We have, therefore, adopted that part of the code for the booklet, and in doing so, discovered that we could greatly simplify the application of the rules into three charts which will give accurately, at a glance, the heating requirements of any room."

New pages, 3-A and 4-A, covering "Determining Size of Warm-Air Pipes," are furnished to replace Pp. 3, 4 and 5 of the original booklet. Also the original chart 1 is cancelled and three new charts are furnished to take its place, covering "Required Size of Pipe for Various Rooms."

Parts 2 and 3 of the Booklet are still to be issued. They will be devoted to "Short Cuts in Estimating Pipe Furnace Installations" and "Pipeless Furnaces," respectively.

ECONOMY OIL HANDLE FOR DIE STOCKS, obviating the need of an oil can, is an interesting device which has been brought out by the Marson Mfg. Co., 462 I. W. Helman Building, Los Angeles, Cal., and described in newly-issued circular matter. Economy oil handles, it is stated, will fit any standard die stock. They contain an inner chamber which holds enough oil for a day's work. By pressing the button in the end of the handle, the oil is forced directly to the die. Waste of oil is prevented by a check valve at the die stock end and a floating valve at the button end.

ECONOMY OIL HANDLE FOR DIE STOCKS

B. & B. ALL METAL THERMOSTAT AND THE B. & B. MULTIFLEX PNEUMATIC VALVE are featured in a new circular issued by The Bishop & Babcock Co., Cleveland, O., pointing out their distinctive characteristics. Mention is made of the fact that the B. & B. temperature control system is installed in such notable buildings as the Pennsylvania Hotel, New York; General Motors Building, Detroit; Pictorial Review Building, New York and the Audobon School, Cleveland. Special mention is made of the fact that it is all metal

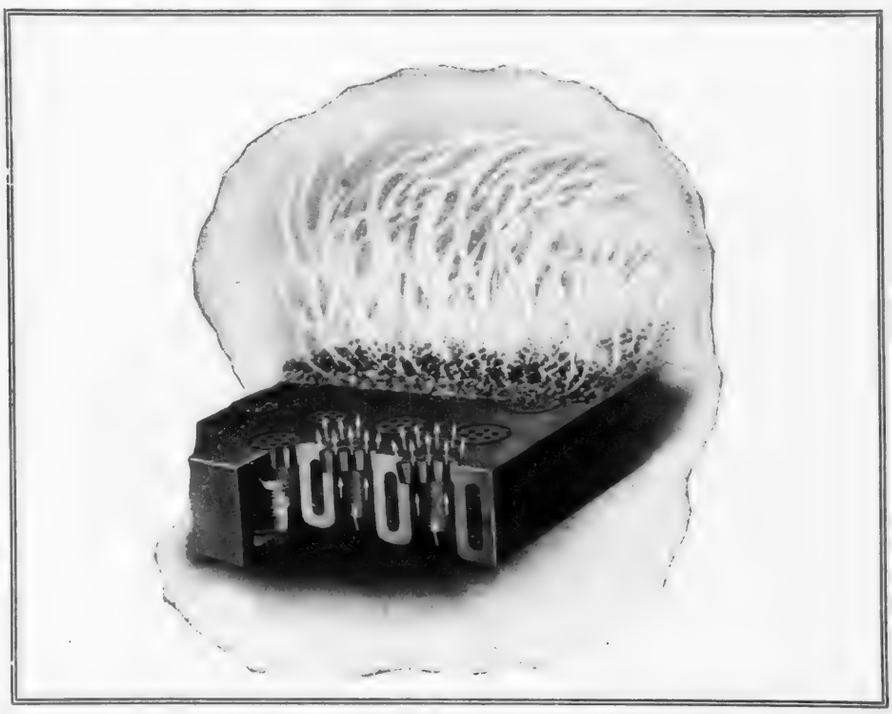
with covers supplied in any finish to match hardware, that it is sensitive to a single degree, that its mechanism is simple consisting of but one moving part, a double-seated air valve operated directly by the thermal member, and that care has been taken in the operation of the thermal member to see that it is not affected by the expansion and contraction of the frame on which it is mounted, as a result of wall temperature. Another feature emphasized is that the themal member is slitted longi-

B. & B. ALL-METAL THERMOSTAT.

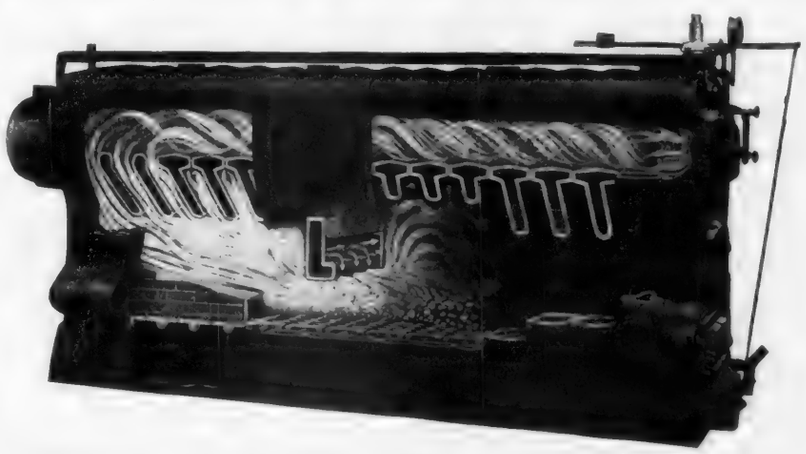
tudinally to eliminate cross deflection and to give added radiation surface. The metal is a sheet of invar, a special nickel steel, having practically no thermal expansion, welded to a sheet of high expansion brass. It is made in two types, the intermediate for two-pipe heating installations, and the positive, for one pipe steam installations. The B. & B. Multiflex pneumatic valve is notable for its multiflex bellows which is made of phosphor bronze, and attached to the head with block tin, not soldered, thus forming an integral head. It is made in all sizes, from ½-in. up.

Utica-Imperial Super-Smokeless Boilers are the subject of a technical data catalogue, the last of a series issued by the Utica Heater Co., Utica, N. Y. Special attention is called to a report on the construction and operation of this boiler, made by Walter S. Timmis, of New York, a well-known heating and ventilating engineer. In addition to carefully-compiled dimension tables, with reference drawings, the data include a table giving ashpit and foundation measurements, a table of minimum chimney sizes, capacities and dimensions of Super-Smokeless boilers, covering and other information. The ratings of the boiler, it is pointed out have been made in accordance with the ruling of the A. S. M. E. and the A. S. H. & V. E.

Culm-Burn Equipment is an interesting type of grate which has been placed on the market by the Culm-Burn Equipment Co., 36 South Seventh St., Philadelphia, Pa., and described in newly-issued circulars. The Culm-Burn grate is water-cooled and of special design to burn low-grade fuels, such as screenings, barley, rice or River coal, with the same heating efficiency as that obtained through the use of prepared sizes of anthracite. The company emphasizes the point that the grate can be installed in an existing boiler, the company furnishing the necessary labor, blowers, piping and other material, preferably through the local heating contractor. In the process of combustion, it is stated, there is no waste. The ashes are fused and drawn out of the fire door. The fact that there is a circulation of water through the grate at all times is mentioned as evidence of its indestructibility. In support of the argument that the grate abstracts more B. T. U. from the fuel burned, the point is made that the fire must burn evenly from the fact that the air is built up in the air chamber to a given pressure. Only sufficient air is allowed to pass through the fire as is required for satisfactory combustion. It is also pointed out that the draft is always in the control of the fireman, regardless of atmospheric conditions.



PRINCIPLE OF OPERATION OF CULM-BURN GRATE.



OPERATION OF THE UTICA IMPERIAL SUPER-SMOKELESS BOILER
(Larger Size)

Is Your Kitchen Telling Its Secrets All Over the House? is the keynote of a circular issued by the Ilg Electric Ventilating Co., Chicago, Ill., devoted to the Portable Ilgair, designed for use in the kitchen and equipped with adjustable hooks which makes it fit easily into the upper third of the kitchen window. An adjustable flap rests on the top of the upper sash when the sash is pulled down, closing the gap between the panel and the outer window pane. The unit, of course, is equally useful in stores, offices and dining and banquet rooms where air removal is desired.

Uehling Instrument Co., Paterson, N. J., has issued a 12-page folder which explains concisely the two most important losses in the steam power plant, namely, the loss in steam turbine economy due to air leakage into the condensing system, and the sensible heat in the flue gases lost up the chimney. The circular features the Uehling combined barometer and vacuum recorder which is described as in effect an automatic log of condenser performance because it re-

cords the existing vacuum, as well as the actual back pressure, for every second of the day. Data on combustion are given, such as the variation of the chimney loss with the percentage of CO_2 and its relation to flame temperature and ratio of air to fuel supply. The Uehling CO_2 recorder and indicator are illustrated.

RA-DO FUMELESS GAS RADIATORS for permanent heating equipment, are presented in a readable catalogue received from The Frank Richard & Gardner Co., 47 South Street, New York. They are furnished in three models, one for medium-sized rooms with a capacity equivalent to 40 sq. ft. of direct radiation, one for stores and large rooms equivalent to 53 sq. ft. of direct steam radiation and one for small rooms, equivalent to 27 sq. ft. of steam radiation. An important feature of the Ra-Do Fumeless gas radiator is its "gas mask" attachment which is used for purifying the heated air and designed to make the air odorless and fumeless. The temperature of the radiators is maintained at a point two and one-half times that of steam radiators of the same size.

HONEYWELL VAPORSTAT AND HONEYWELL AQUASTAT are discussed in a newly-issued circular received from the Honeywell Heating Specialties Co., Wabash, Ind. The Vaporstat is designed to control the boiler pressure at any predetermined point. It acts to operate the motor controlling the drafts. When connected with motor and thermostat the motor is directly actuated by the thermostat which maintains the desired room temperature. But if the boiler pressure reaches a predetermined high point, then the Vaporstat makes contact, automatically cuts out the thermostat, starts the motor and closes the drafts, regardless of the room temperature. Honeywell Vaporstats are particularly adaptable in connection with oil and gas-fired boilers. They are threaded for ⅜-in. pipe opening and can be readily attached to existing plants. They are made in two ranges, one graduated in ounces up to 3 lbs. and the other for operation from 3 to 10 lbs. The Honeywell Aquastat is designed to control the temperature of liquids or air up to 300° F. This instrument, like the Vaporstat, operates in conjunction with Honeywell room temperature regulators. It has been found especially useful in industrial work where inaccuracy or sluggish response would result in loss or danger through overheating. It also functions as a temperature limiting device on water heating systems. The scale of the Aquastat provides for a variation of 100°, the standard scale ranging from 100° to 200°.

YOUNG CENTRIFUGAL VACUUM AND BOILER-FEED OUTFIT, for removing the air and condensation from steam heating systems, and described as equally adaptable for all conditions where a wet or dry vacuum is required, is described and illustrated in a catalogue received from the Young Pump Co., Michigan City, Ind. The "YVM" outfits are made in sizes ranging in capacity from 8000 to 65,000 sq. ft. of radiation, these capacities being based upon direct radiation or its equivalent, the outfits to carry 10 in. of vacuum on a tight system when the temperature of the returns does not exceed 180° F. Standard outfits are made to carry 20 lbs. pressure on the pump, and are designed to discharge against this pressure in the boiler, less the friction in the discharge line and the difference between the pump discharge and the water level in the boiler. The outfit, it is noted, is shipped assembled and connected up.

Send in Your Slogan for the Heating and Piping Industry.

Fifty dollars is yours if you can think of the best slogan for the Heating and Piping Contractors' Association and another fifty dollars if you devise the best idea for a trade mark for the association. These prizes are announced by the association's Committee on Slogan and Trade Mark. Here are the rules of the competition:

All slogans and insignia are to be mailed to the secretary, Henry B. Gombers, 50 Union Square, East, New York, and should bear on the envelope the caption, "Slogan Competition."

Competitors should use paper 8½ in. x 11 in. in size and place name and address in upper left-hand corner of each sheet submitted. Any number of ideas can be submitted by one person—the more the merrier—the only restriction being that the material must be original.

All slogans and insignia must be received on or before April 30, 1923. The decision of the committee will be announced at the forthcoming annual convention of the association in Chicago, May 23-26.

Deaths.

William S. Ransom, Eastern New York representative for Trane Company and one of the oldest and best known heating salesmen in the East, died in New York, January 21, after a brief illness. Mr. Ransom was previously connected with the Beach-Russ Company, New York and for nearly 50 years before that had been identified with the heating trade. It was always a treat to hear Mr. Ransom tell of his reminiscences, as his host of friends and acquaintances embraced the leading figures in the industry through two generations. He was 75 years old.

THE LATE WILLIAM S. RANSOM.

Albert H. Ross, New York branch manager of the United States Radiator Corporation, Detroit, Mich., died in New York February 23. The announcement of his death comes as a shock to his many friends who had looked for his complete recovery from the severe attack of nervous prostration he suffered a year ago. He had shown much improvement and had long since resumed his place in the trade. Mr. Ross was of such a charming personality and had apparently so many years of usefulness before him that it is hard to believe his career has come to such an untimely end. He was a member of the American Society of Heating and Ventilating Engineers and was actively indentified with the New York Chapter.

G. A. Fromm, assistant treasurer of the Kewanee Boiler Co., Inc., New York, died February at his home in Rockville Center, Long Island, following an operation for cerebral tumor. Mr. Fromm had filled responsible positions with the American Radiator Company as a sales and credit manager and, for the past two years, had been connected with the Kewanee Boiler Co., Inc. He was 40 years old. He leaves a widow and three children.

Edward B. Tyler, head of the Tyler Underground Heating System, Wilkinsburg, Pa., and a well-known figure at conventions of the National District Heating Association, died suddenly of heart disease at Saint Clair, Mich., where he had gone on a business trip. Mr. Tyler was 60 years old. He had been subject to severe heart attacks which mitigated somewhat the shock of his death. He was the founder of the business which bore his name and it represented the best efforts of his life, as all of the company's products were the result of his own ideas. He leaves a widow and one married daughter. He was a 32nd degree Mason and a Knight Templar.

C. W. Thomas, president of the Scott Valve Mfg. Co., Detroit, Mich., an old-time figure in the brass manufacturing industry, died in Chattanooga, Tenn., January 21, while on his way to Florida, where he was accustomed to spend the winters. Mr. Thomas became connected with the brass industry in 1888 when he bought a controlling interest in the Roe-Stephens Mfg. Co., of Detroit. This firm was reorganized in 1919, taking the name of the Scott Valve Mfg. Company. During the past few years Mr. Thomas had made his home in Ypsilanti. He was a member of the Ingleside club, Ypsilanti Board of Commerce and the Washtenaw County Club. He is survived by his widow, ten sons and three daughters.

To Architects and Heating Engineers: The IDEAL TYPE A HEAT MACHINE is performing in hundreds of other homes, from smaller homes to fine mansions, churches, schools, apartment houses, hospitals, banks, theatres and office buildings. Send to either address below for the attractive book that describes, with test charts and illustrations, the reasons for its marked success.

"ALMOST HUMAN"—says Mr. Goodall

EDWIN GOODALL of Hackensack, N.J., took out his old-fashioned wasteful heating plant and installed an IDEAL TYPE A BOILER.

"I am told you call it a 'Heat Machine'," he writes. "I call it almost human; its appetite is exceedingly considerate of my pocket-book."

Mr. Goodall has learned by experience the secret which doubtless many of your clients, when building, may overlook; that the slightly greater initial cost of a *good* boiler is nothing compared with the coal it saves in a life-time of service.

The IDEAL TYPE A HEAT MACHINE—an aristocrat in appearance—is a *working* aristocrat in performance. It soon pays back its cost in the coal that it saves. That alone makes it worthy of your specification.

AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

104 West 42nd Street, Dept. T14
NEW YORK

AMERICAN RADIATORS | IDEAL BOILERS

816 So. Michigan Ave., Dept. T14
CHICAGO

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING

The O-E Perfect System.

In the design of the O-E Perfect vapor system, every effort has been made to reduce the number of parts to the fewest possible. As will be seen from Fig. 1, the special devices used are limited to packless graduated radiator valves, water-seal ball-check union elbows on the radiator returns and a combined air exhauster and vacuum valve located on the return main near the boiler.

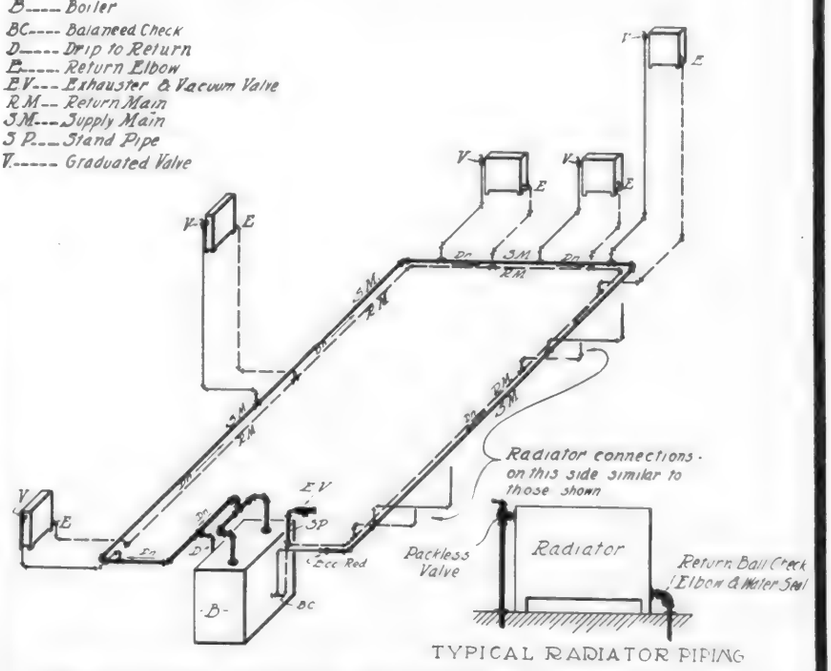
Vapor generated in the boiler passes up through the main supply pipe to the several radiators through small individual supply pipes from the main. The vapor is admitted to each radiator at the top through an O-E packless graduated valve. As the vapor condenses in the radiator, the water of condensation falls to the bottom of same and is returned to the boiler through a ½-in. O-E elbow connected into a ½-in. pipe, thence into the main return pipe in the basement.

In passing through the elbow the water is first trapped by a wall or diaphragm, cast in the elbow outside of the radiator (Fig. 3) making a water seal which is designed to hold the vapor in the radiator and to prevent it from short-circuiting into the return main.

To avoid water being drawn back into the radiators when the supply valve at the top of the radiators is closed, provision is made in the O-E elbow to avoid this trouble by equipping it with a small brass ball operating on a smooth guide or track and arranged so that when the vacuum is formed in the radiator the ball will immediately roll against the port and prevent water from being drawn into the radiator from the return pipe. Noiseless operation is secured by having the water seal below the ball. The opening of the supply valve at the top of the radiator causes the ball in the elbow to roll off its seat, permitting condensation and air to pass into the return main. An air vent is tapped in the adjustable screw top of the return elbow to allow the air to escape freely into the return system when the supply valve is open and also to equalize the pressure on both sides of the water seal, thus preventing it from siphoning out.

(*Concluded from Data Sheet No. 132-NN*).

B—— Boiler
BC—— Balanced Check
D—— Drip to Return
E—— Return Elbow
EV—— Exhauster & Vacuum Valve
RM—— Return Main
SM—— Supply Main
SP—— Stand Pipe
V—— Graduated Valve


Radiator connections on this side similar to those shown
Packless Valve
Radiator
Return Ball Check Elbow & Water Seal
Ecc Red
TYPICAL RADIATOR PIPING

O-E VAPOR-VACUUM-PRESSURE SYSTEM

VAPOR HEATING—The O-E Perfect System. No. 132-MM

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING—The O-E Perfect System.

(*Continued on Data Sheet No. 132-NN.*)

All air and condensation pass through the main return pipe in the basement to a point above the boiler where the air is separated from the water. Air passes up and through the O-E exhauster (Fig. 4) into the chimney flue or any place desired, while the water returns to the bottom of the boiler.

The O-E air exhauster and vacuum valve is connected at a high point above that where the return main drops down to the return opening in the boiler. The exhauster remains open while there is any air in the system. As soon as heat comes into contact with a carbon post in the exhauster, the post expands and forces a hollow brass ball against the seat, closing the port. When closed the system will cool slightly, causing a vacuum to form and this will hold the ball on the seat of the exhauster as long as there is a vacuum in the system. As soon as the vacuum is broken, on account of air

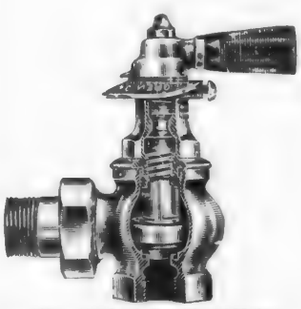


Fig. 2—O-E Packless Valve.

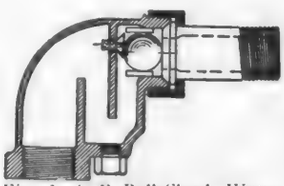


Fig. 3—O-E Ball-Check Water-Seal Return Fitting.

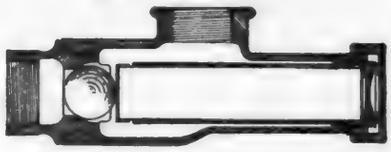


Fig. 4—O-E Air Exhauster

getting into the system, the ball will roll away from the seat in the exhauster, again permitting the air to escape.

Means to make the exhauster fool-proof are taken by having a brass shell or reinforcement around the carbon post, with a brass cap over the end of the post, to prevent the post from getting out of shape if, for instance, it should be screwed down against the seat when cool. The cap locks the expansion post after it is properly adjusted. All exhausters are set for ordinary use, but can be adjusted to suit any particular system to which they are attached. They are threaded 1 in. both inlet and outlet.

The O-E packless valve (Fig. 2) used with this system is of the usual quick-opening type, with a handle made of hard rubber and having a graduated dial and pointer. The dial is cast on an angle so as to be easily read from some distance.

The ball-check water-seat union elbow is made in one size only, ½-in., and the air exhauster and vacuum valve is also made in but one size, 1-in. The O-E packless graduated valve comes in three sizes, ¾-in, 1-in. and 1¼-in. The system is manufactured by the O-E Specialty Mfg. Co., Milwaukee, Wis.

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

TABLES FOR VENTILATING DUCTS

The accompanying tables (Nos. 11-E to 11-J, inclusive) give the superficial area and weights of galvanized sheet-iron rectangular ducts. The tables, six in number, embrace all sizes from 1 in. up to 60 in. square.

In the central portion of each table are placed the cross-sectional dimensions of the ducts in inches, those in the first (or the last) column representing one dimension and the intervening quantities the other dimension. The latter are so arranged that all sizes of ducts having the same circumference appear in the same vertical column and, therefore, have the same superficial area per lineal foot of length.

The inclined line divides the two portions of the table so as to utilize the whole form, and the resulting quantities are read either up or down, according to which side of this line the second dimension of the duct occurs.

For example referring to Data Sheet No. 11-E for 8 in. x 18 in., the latter dimension will be found on the other side of the inclined line, and the resulting quantities are obtained by reading downward in the column in which 18 appears, in the same manner as before.

The quantities given under caption, "Square Feet per Lineal Foot" are for actual outside surface and are useful when calculating painting, non-conducting coverings and the like. The quantities given under "Weight per Lineal Foot," however, have allowances made for seams and are all based on the assumption that ducts are cut from 30 in. wide sheets and that one lap of 1 in. is required for each sheet so used. In other words, ducts up to 29-in. circumference allow one lapping inch; from 30-in. to 59-in., two lapping inches, and so on up to 60-in. x 60-in., which having 240 in. circumference are allowed 9 lapping inches in the table of weights.

No attempt has been made to allow for waste material, bracing or hanging and some percentage should be added to the tabulated quantities to take care of these. For ordinary purposes, 10% to 15% will be found sufficient, but obviously no exact rule can be laid down, on account of the varying conditions of practice.

DUCTS AND FLUES—Area and Weight of Ducts. No. 11-D

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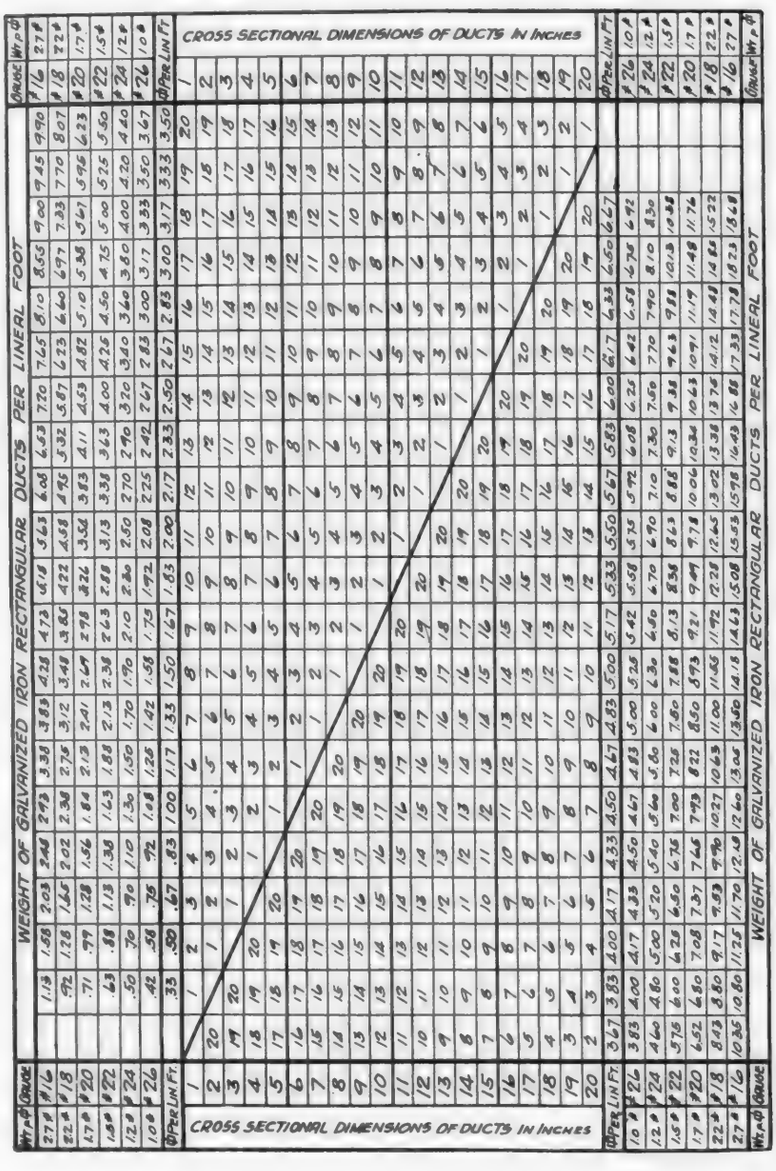
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

TABLES FOR VENTILATING DUCTS.

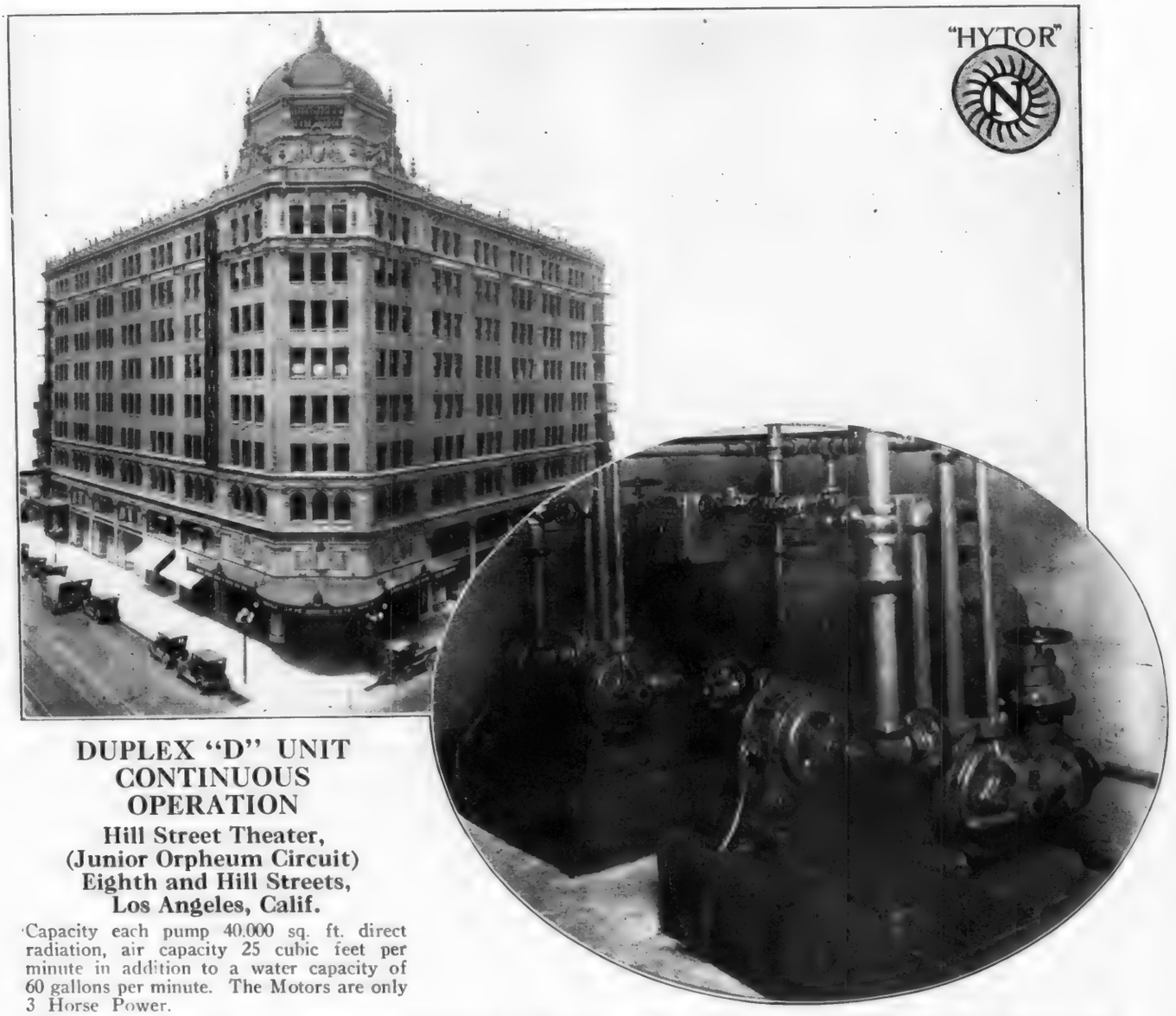
Superficial Area and Weight of Galvanized Sheet Iron Rectangular Ducts.


WEIGHT OF GALVANIZED IRON RECTANGULAR DUCTS PER LINEAL FOOT
CROSS SECTIONAL DIMENSIONS OF DUCTS IN INCHES
WEIGHT OF GALVANIZED IRON RECTANGULAR DUCTS PER LINEAL FOOT
CROSS SECTIONAL DIMENSIONS OF DUCTS IN INCHES

DUCTS AND FLUES—Area and Weight of Ducts. No. 11-E

Copies of this Data Sheet, printed separately, 5 cents each.

EFFICIENT HEATING
demands the JENNINGS PUMP



DUPLEX "D" UNIT
CONTINUOUS
OPERATION

Hill Street Theater,
(Junior Orpheum Circuit)
Eighth and Hill Streets,
Los Angeles, Calif.

Capacity each pump 40,000 sq. ft. direct radiation, air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The Motors are only 3 Horse Power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs, is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 15 gives them in detail. Write for it.

THE NASH ENGINEERING CO.
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BOSTON—185 Devonshire Street
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DENVER—Boston Building
DETROIT—Kerr Building
HOUSTON—Southern Pacific Building
INDIANAPOLIS—Hume-Mansur Bldg.
KANSAS CITY—Mutual Building
LOS ANGELES—218 East Third Street
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WASHINGTON—710 14th Street, N. W.

The NASH ENGINEERING COMPANY
SOUTH NORWALK, CONN., U. S. A.

Trade and Miscellaneous Notes

Coming Events

April 18-19, 1923.—Annual meeting of the National Metal Trades Association, at the Hotel Astor, New York.

May 23-26, 1923.—Thirty-fourth annual convention of the Heating and Piping Contractors' National Association, in Chicago, Ill.

June 20-23, 1923.—Fourteenth annual meeting of the National District Heating Association at Cedar Point, O.

June 26-28, 1923.—Forty-first annual convention of the National Association of Master Plumbers, in Atlantic City, N. J.

Miscellaneous Notes

Duluth, Minn., will stage its first annual building show April 2-7, 1923, in the Duluth Armory.

Central Supply Association held its 91st regular meeting in Chicago, February 21-22, at the Drake Hotel, with a record attendance for a winter meeting. Interesting surveys were presented of the work of the National Trade Extension Bureau, R. E. Maloney speaking on "Catalogue Standardization." H. E. Jones on "Industrial Development" and Manager William J. Wooley on "Building for the Future," in which he stressed the need of training apprentices. Among the speakers at the afternoon session on the first day were W. E. Clow, Jr., L. J. Merkel, C. V. Kellogg and H. M. Johnson. A notable address was delivered at the morning session on the second day by Douglas Malloch of New York, in which he combined humor of an unusual order with some sound business sense. The concluding session in the afternoon was devoted to reports on the industries. Firms elected to membership included the O-E Specialty Mfg. Company, of Milwaukee, and the Central Specialty Co., of Detroit. It was decided to hold the autumn meeting of the association at the Drake Hotel, Chicago, October 3-4.

Urbana, Ill.—Members of the Chicago Heating and Piping Contractors' Association attended a post-graduate course in heating and ventilation given at the University of Illinois during the first week of February.

National Safety Council has accepted the invitation of the Buffalo Chamber of Commerce to hold the 1923 National Safety Congress in Buffalo, October 1-5. Headquarters will be at the new Statler Hotel.

National Boiler and Radiator Manufacturers' Association held its annual dinner at the Hotel Astor, New York, January 24, the principal speaker being Harry A. Wheeler, vice-president of the Union Trust Company.

St. Louis Association of Heating and Piping Contractors elected the following officers at its annual meeting, held January 24: President, Joseph F. Gunn; vice-president, William Sodemann; treasurer, E. P. Ambler, Jr.; secretary, T. J. Sullivan; sergeant-at-arms, James E. Westbury.

St. Louis Technical Institute has issued a new prospectus outlining a special course in heating and ventilation.

Atlantic City N. J.—An American Exposition Fair, under the auspices of the American Home and City Beautiful Association, will be held in Atlantic City, on Young's Million-Dollar Pier, from June 16 to September 8, 1923. The management of the exposition is in the hands of A. Conrad Ekholm. The exposition will be in full swing at the time of the annual convention of the National Association of Master Plumbers, June 26-28. All of the exhibit floor space of the Young Pier, in excess of 100,000 sq. ft., has been engaged for

Three famous fans

There are three famous fans that figure in this country of ours—the movie fan, the baseball fan and the Autovent Fan. To you, the one of most importance is the Autovent Fan. It is the fan necessary to your work, it is the fan that enters upon your daily professional and business activity.

And for years those in the ventilating field have known the Autovent Motor Driven Propeller Fan for its efficiency and adaptability to seemingly impossible conditions. They have also known it for neatness in appearance and ease of installation. And knowing its good points they have specified it, as thousands of installations show.

The Autovent Fan has solved many ventilating problems. It can solve yours.

AUTOVENT FAN & BLOWER COMPANY

730-38 West Monroe St., Chicago, Illinois

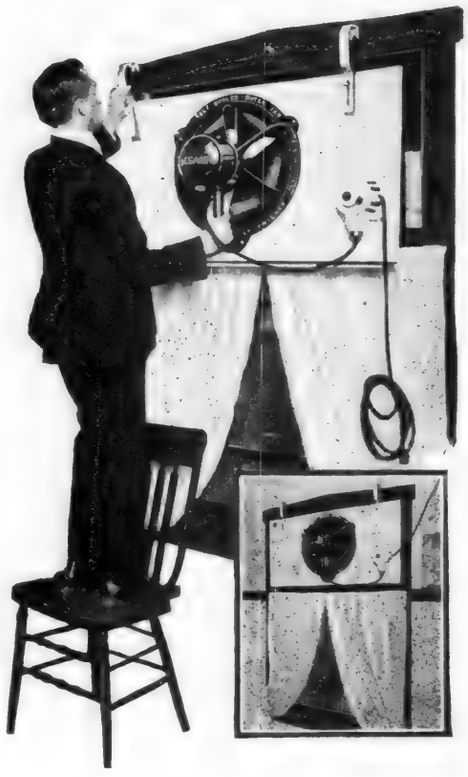
REGISTERED AUTOVENT

the exhibit. One of the features will be a "Home Beautiful," equipped with the most modern devices. A special section will be given over to systems and apparatus for heating and ventilating the home.

January Construction is 31% ahead of last year, according to the F. W. Dodge Company's reports. The total contracts awarded in January in the 36 Eastern States amounted to $242,755,000. Residential construction constituted 51% of the January total, amounting to $122,695,000. Second in importance were business buildings, 12% of the total. Other important items were public works 12%, industrial buildings 10% and educational buildings 7%. In New England the figures came to $22,770,400, which was the largest January total on record. In New York State and northern New Jersey the building contracts totalled $64,242,00, an increase of 14% over December and of 18% over January, 1922. The Middle Atlantic States reported $32,506,000, the second largest January total on record, 56% greater than the corresponding month a year ago. In the Southern States the figures were $25,189,000. The Pittsburgh district showed figures of $27,002,000, 13% above those for January, 1922. In the Central West, another record-breaking total was reported of $68,051,000, 41% better than January, 1922. A loss was reported from the Northwest where the figures of $2,994,000 were 1% below those for December and 41% below those of January, 1922.

Charleston, S. C.—A new hotel is to be built in Charleston, S. C., to be known as the Fort Sumter Hotel. The owner is the Fort Sumter Hotel Company, of which Edward J. Murphy is president. To finance the building an issue of $515,000 first mortgage bonds has been underwritten by G. L. Miller & Company, of New York and Atlanta.

Chamber of Commerce of the United States is advocating the voluntary adoption of standards of quality. In a discussion on the subject President Julius H. Barnes notes that "business is facilitated and the ground for commercial disputes between buyer and seller is narrowed down if sales are made on the basis of standard grades of merchandise, perfectly familiar to both buyer and seller." Trade associations are being urged to take up the matter on a more extensive scale. Among the materials in need of better standardization are mentioned copper and other



THE NEW PORTABLE ILGAIR VENTILATOR

HERE'S another Ilg development—the **Ilgair Portable Panel**—just the thing for homes, offices, stores, hotels, etc., where a permanent installation is not desirable.

It's the greatest idea for 1923. Fits any window—can be installed in a jiffy. No screws or nails required—simply hang it like a picture on the wall, then make connection with a nearby lamp socket, and the job is done.

MADE IN THREE SIZES TO TAKE CARE OF WINDOWS RANGING FROM 25" TO 48" WIDER IF NECESSARY AT ONE COST—NO EXTRAS

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HIGH EFFICIENCY ILG VENTILATING MACHINERY

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FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

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BRANCHES IN ALL PRINCIPAL CITIES

U.S.A. Safeguards its Priceless treasures with Carrier Air Washers

ORIGINAL historical relics in Freer Museum of the Smithsonian Institute, which portray the history of the world—are protected from destruction by dust accumulation, and the comfort of visitors or employees is put under absolute control, by means of conditioned Air.

Protect the human treasures in school or assembly places with

Carrier Air Washers

which wash all the germs and dirt from the air before it enters the heating coils.

Carrier Air Washers—are simple and foolproof, require no priming of pump, have non-clogging nozzles which require no high pressure, use screens with ample surface, are easy of access and quickly cleaned in a few minutes.

Tell us your problem and get the whole story from our engineers without obligation. Address Dept. #36.

Carrier Air Conditioning Company of America,

480 BROADWAY, BUFFALO, N. Y.

metals, cement, various chemicals, iron and steel products, and a whole range of engineering materials.

National Foreign Trade Convention will be held in New Orleans, May 2-4, 1923, according to an announcement of O. K. Davis, secretary of the National Foreign Trade Council. This will be the tenth convention which the council has held. Special attention, it is stated, will be paid to the European situation, the part played by imports in our national life and transportation by rail and water.

Pittsburgh, Pa.—The recent election of Dr. Thomas Stockham Baker to the presidency of the Carnegie Institute of Technology calls to mind the remarkable growth of this college since its establishment 29 years ago. Its enrollment this year is about 4299 students, while the faculty numbers nearly 400.

Hornell, N. Y.—One of the best-known landmarks of Hornell was destroyed when fire burned the Lincoln Grammar School in that place, February 6. The building had been in use 49 years. The Hornell Board of Education is already planning a new $260,000 building to be erected on the same site. Tooker and March, it is stated, will be the architects for the new building, this firm having had charge of the remodeling of the building some time ago. They are also the architects of the new high school building, now under construction in Hornell.

Cleveland, O.—Cleveland's new Union Station has been begun under the direction of Harry D. Jouett, chief engineer. The entire project, including the Hotel Cleveland, already completed, will average thirteen stories in height and will cover ten city blocks. Hotel Cleveland is the first completed unit of the terminal project and will become an integral part of the Union Station when finished. In addition to the 1000 rooms in the present building, an 800-room addition must be added to take care of increased business, according to Manager Edward M. Buel. The Cleveland Union Terminals Project, it is stated, is a part of the largest railway development now under way in the United States. In addition to a high-level freight yard, all electric interurban lines entering Cleveland will run into the station and will connect with all city lines under the same roof. All steam roads will be electrified within the city. In order to obtain a belt line connecting all railroads and a right of way through the city, it was necessary to purchase the entire Nickel Plate Railroad from Buffalo to Chicago. O. P. and M. J. Van Sweringen, of Cleveland, are at the head of the undertaking.

Cleveland,—Realtors National Exposition of Building Ideas will be held in Cleveland, June 25-30, under the management of the National Association of Real Estate Boards. The exposition will be held, as last year, in the new Public Auditorium. According to the preliminary announcement, it will be the greatest exposition of building ideas ever staged in this country. The whole affair is being arranged as a feature to the sixteenth annual convention of the National Association of Real Estate Boards. All classes of building materials used in the construction of both domestic and commercial buildings will be on display. Headquarters for the exposition are in the rooms of the Cleveland Real Estate Board, in the Swetland Building, Cleveland, where a force of assistants under Manager Tom Convey are already at work on the details for the building ideas exposition.

Albany, N. Y.—The **Industrial Bulletin,** published monthly by the Industrial Commission of New York State, states that "plans for construction work on industrial buildings of the state, outside of Greater New York, which were submitted to the department's Engineering Division during the calendar year ended December 31, 1922, represent an expenditure of nearly $6,400,000 in excess of the amount of 1921. The total for the last year was $15,730,167, as compared with $9,334,221 for 1921. Of the total expenditure represented by these plans, over $14,000,000 was for new construction. In the preceding year the whole amount for new construction was $8,290,000.

EFFICIENT HEATING

Demands radiators so constructed that every square foot is prime heating surface.

Bayley's Chinook Heaters

are built on the "Tube-Within-A-Tube" principle, every tube a complete radiator in itself, free from water hammer, return bends, elbows and nipples. Any tube can be removed without interference with any other tube. Can be shipped K. D.

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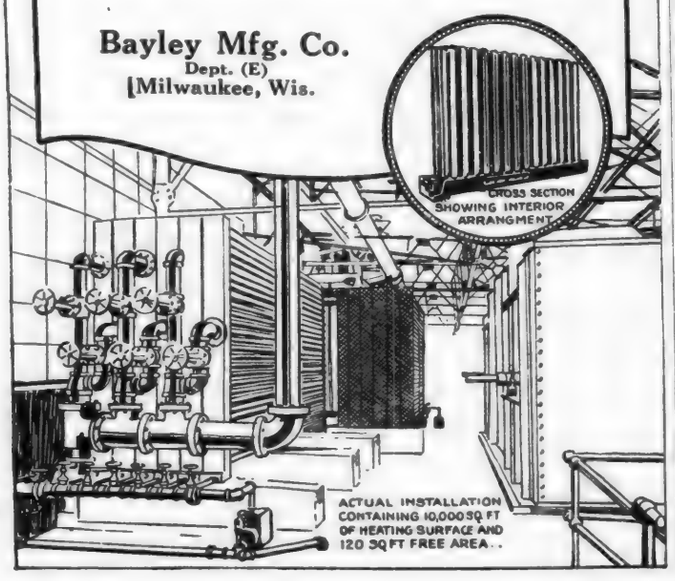
Bayley Mfg. Co.
Dept. (E)
Milwaukee, Wis.


CROSS SECTION SHOWING INTERIOR ARRANGMENT
ACTUAL INSTALLATION CONTAINING 10,000 SQ FT OF HEATING SURFACE AND 120 SQ FT FREE AREA

By appearance and satisfactory performance have Massachusetts Squirrel Cage Fans merited their continued use in buildings of all classes.

MASSACHUSETTS BLOWER CO.
WATERTOWN, MASS.

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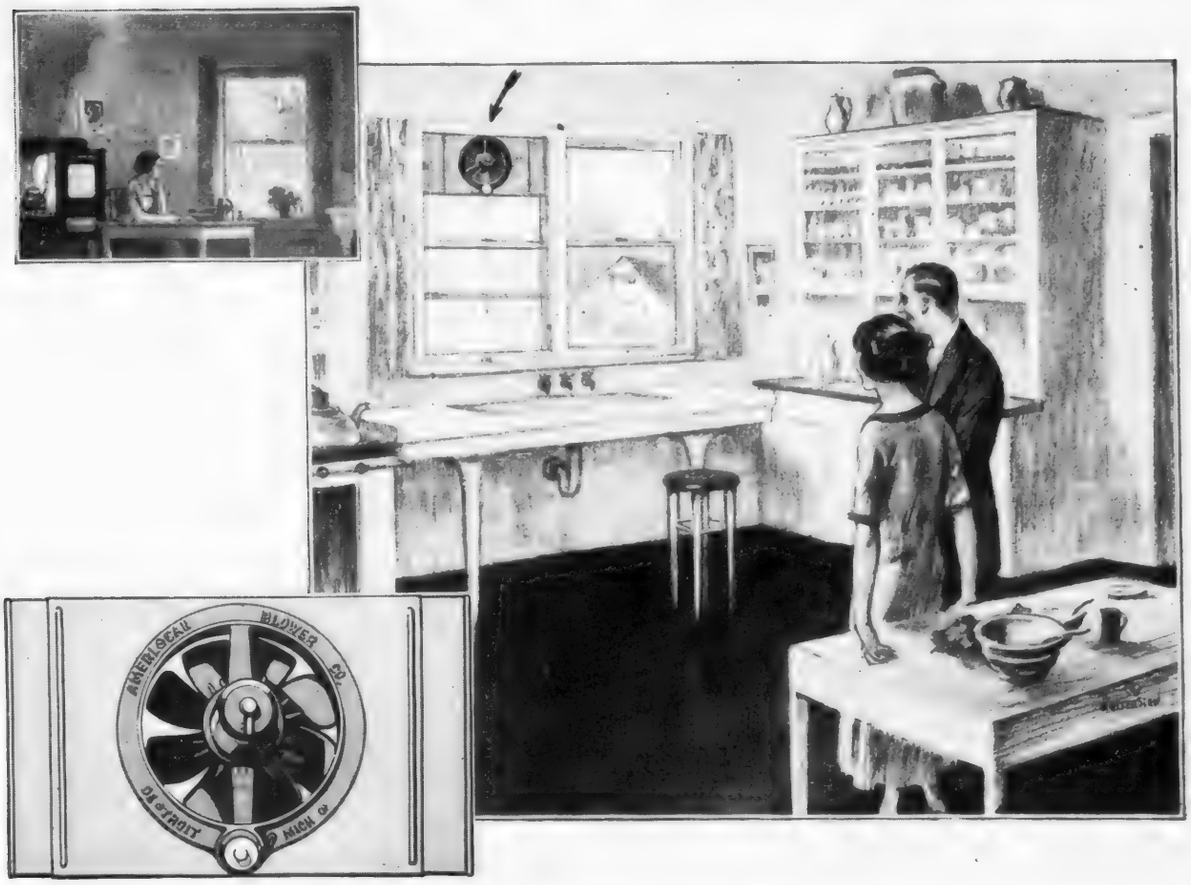


This Household Appliance—

Makes Kitchens Pleasant and Comfortable

Architects and ventilating engineers will find that the new American Blower Kitchen Fan instantly meets with the approval of every housewife. Running in one direction the fan takes out the fumes—odors—smoke—and hot stifling air. Then by simply pulling the cord the fan runs in the opposite direction and brings in the cool invigorating outdoor atmosphere.

You will find that practically every woman will want her new kitchen equipped with this practical fan, and you may easily specify it without changing your specifications in any way. For with the adjustable fan frame it may be installed in any kitchen within twenty minutes.

The kitchen fan is but one of our various types of ventilating fans. We make ventilating equipment for offices, theatres, school buildings, stores, factories, laundries, and business places of all kinds and sizes.

Our Engineering Department will gladly cooperate with engineers and architects in the selection and installation of any type of ventilating equipment.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO (247)

American Blower

"Sirocco" TRADE MARK

EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

Associated General Contractors of America held its national conference and annual meeting in Los Angeles, Cal., January 30-February 2. In the building contractors' division papers were presented on "Consolidation of Crafts in the Building Trades" and "Standardization of Construction Methods." Among the more important of forty activities recommended for 1923 are the following:

Secure passage of laws by states restricting construction work by public officials.

Hold conference of construction cost accountants to develop standard system of cost accounting.

Develop standard estimating forms for builders and highway contractors, quantity take-off rules, estimating guide sheet for buildings, highways, etc.

Urge payment for estimating where quantities are not given.

Hold conference on standardization of equipment and materials.

Study and begin standardization of construction methods.

Develop universal document and standard contracts.

Urge award of contracts on basis of skill, integrity and responsibility.

Urge reorganization of labor unions into fewer branches, including related crafts.

Urge revision of apprenticeship rules and increase number of apprentices.

Maintain National Board for Jurisdictional Awards in the building industry.

Urge standard construction safety code.

Secure restriction or elimination of preferential allocation of cars, to provide equal sharing by all industries.

Secure free wholesale market for materials.

Secure elimination of inequitable trade practices, affecting terms of sale, delivery and payment.

Cooperate with Hoover Committee to standardize codes.

Formulate and issue code of ethics for contractors in relations with subcontractors.

Discourage the practice of letting building contracts piecemeal.

Develop research work and investigation, especially in methods, contracts and materials, legislation and transportation.

J. W. Cowper of Buffalo was elected president of the organization for the ensuing year.

Manufacturers' Notes.

B. F. Sturtevant Co., Hyde Park, Boston, Mass., has established a Pacific Coast branch factory in Oakland, Cal., where a modern one-story building, with a floor space of 45,000 sq. ft., has been acquired at Blake and Sixth streets. A separate California corporation has been formed to handle the Pacific Coast trade under the name of the B. F. Sturtevant Company, of which Charles C. Hardy, of Oakland, is president. B. S. Foss, son of E. N. Foss, president of the parent company, is treasurer of both concerns. The Pacific Coast factory will manufacture the Sturtevant products for Montana, Wyoming, Idaho, Colorado, New Mexico, Arizona, Nevada, Utah, Washington, Oregon and California. There will be branch offices in Salt Lake City, Seattle, Portland and Los Angeles. The B. F. Sturtevant Company was founded in 1850. It is capitalized at $3,750,000 and does an annual business of some $10,000,000. As is well known, the company's products include all types of fans, blowers, exhausters, engines, vacuum cleaning machinery, and industrial dryers and dry kilns.

Columbus Supply Co., Columbus, O., jobbers of heating and plumbing supplies, has leased for ten years the entire four-story and basement building at 243 245 North Front Street, giving the company larger and more convenient facilities, with 25,000 sq. ft. of floor space. The company was established in 1886. President and treasurer, W. L. Stehle; secretary, J. M. Grimm.

Two Rivers, Wis.—The return to his home town, Two Rivers, of Henry Baetz, of St. Louis, Mo., inventor of the Skinners Bros. (Baetz patent) portable unit fan blast heater, is made the occasion of an appreciative article in the Two Rivers *Chronicle* extolling Mr. Baetz's achievements and giving some interesting details of the installation of the Skinner Bros. heaters in the U. S. Government airship hangar in Lakehurst, N. J.

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools

LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

HERSH BROTHERS CO.

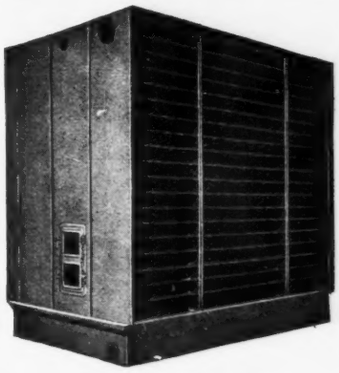
654 Mill Street **ALLENTOWN, PA**

Peerless Ventilator

BUILT RIGHT RUN RIGHT

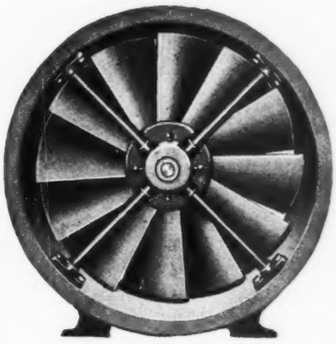
The New York Blower Co.

Chicago, Ill. La Porte, Ind.



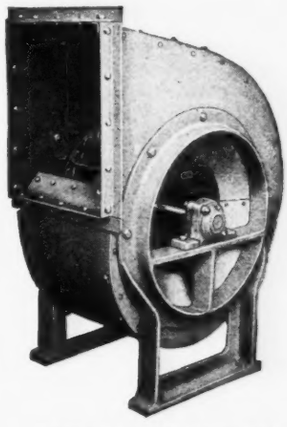
Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.



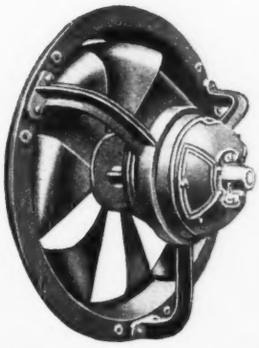
Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.

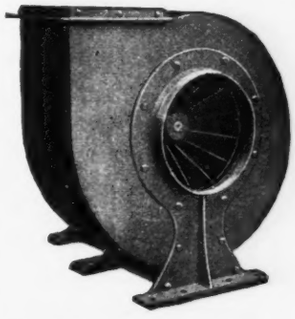


Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.



Motor Driven Propeller Fan

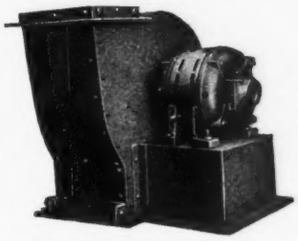


Slow Speed Planing Mill Exhauster

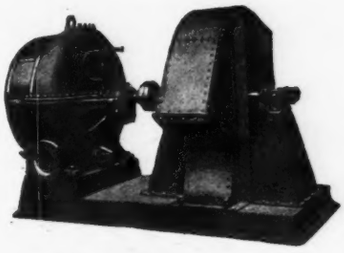
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

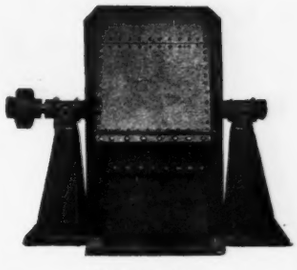
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

Chicago Pump Co., Chicago, Ill., received what is believed to be the first radio foreign order when a London concern sent a radio to New York, February 10 for some of the company's pumps. The order was mailed from New York to Chicago the next morning and reached the office of the Chicago Pump Company February 13.

Kewanee Boiler Co., Kewanee, Ill., held its annual sales conference recently. It was attended by 70 of its salesmen.

Utica Heater Co., Utica N. Y., held a conference of its executives and sales representatives at the Sherman Hotel, Chicago, January 23-24, which was attended by twenty-five of the company's representatives, including Vice-President Campbell E. Hodges, James K. Norris, Utica; James Doherty, Chicago; James J. Mason, Cleveland; and H. R. Dillon, New York.

Pierce, Butler & Pierce Mfg. Corporation, New York, has appointed Wallace F. Goodnow to its sales force. Mr. Goodnow was until recently connected with the Caloroil Burner Co., of New York.

Mine & Smelter Supply Co., with branches in Denver, Salt Lake City and El Paso, has taken over the exclusive representation of the Wilson Welder & Metals Co., of New York, for the States of Colorado, Utah, Nevada, Wyoming, New Mexico and Western Texas. The company will handle the Wilson Plastic-Arc welders and Wilson Color-Tipt welding metals. These products became internationally known during the World War when they were used extensively in repairing the damage done to a large number of the interned German vessels.

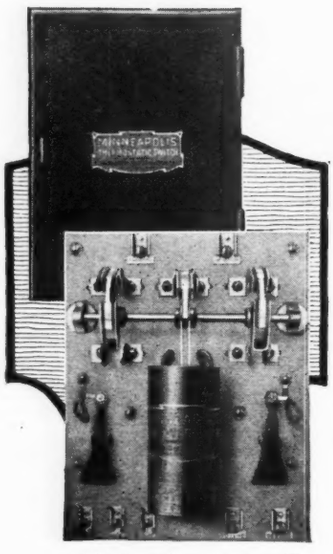
H. & P. Sales Co., St. Louis, Mo., which for the past few years has been operating as a partnership, has now been incorporated under the laws of Missouri, with offices at 710 Rialto Building, St. Louis, and 1104 Republic Building, Kansas City, Mo. The officers of the corporation are: President, F. P. Hitchcock; and C. A. Pickett and J. F. D. Howell. The entire time of the officers of this corporation is devoted to the sale of the products of the Herman Nelson Corporation, Moline, Ill., manufacturer and engineer for the Moline Heat system of heating and the Univent System of ventilation in the State of Missouri and the southern portion of Illinois.

Universal Unit Ventilation System, Atlantic City, N. J., announces the opening of a New York office at 48 East 41st Street, in charge of H. M. Goldberg. The Universal Unit Ventilation System is manufactured by John J. Nesbitt.

Autovent Fan & Blower Co., Chicago, Ill., manufacturer of Autovent propeller fans and louvres and Uniblade standard pressure and volume blowers, announces the appointment of H. E. Prior as its district representative in Cleveland, O. Walter M. Jones has been appointed district representative for the Rochester (N. Y) territory, with headquarters in Rochester (P. O. Box 583). H. J. Ryan, 91 Elm St., Albany, N. Y., is representing the company in the territory comprising Albany and surrounding vicinity. Arthur J. Purcell, 631 New Britain Ave., Hartford, Conn., has been appointed representative in the Hartford territory. Neeves & Co., 111 Monument Circle, Indianapolis, Ind., has taken on the company's line in the Indianapolis territory. It is the intention of the company to appoint sales engineers in various parts of the country with a view of offering high-grade co-operation and service to heating and ventilating concerns and sheet metal contractors in connection with their requirements for ventilating equipment.

Mouat-Squires Co., Cleveland, O., manufacturer of the Mouat vapor heat system, has changed its name to the Mouat Vapor Heating Company.

Sprague Electric Works of the General Electric Co., whose offices have been located at 627 West 34th St., New York, will be conducted hereafter as the Engineering Building Equipment Section of the General Electric Company, with headquarters at 120 Broadway, New York. The section is under the management of Fred S. Hartman. Henry G. Issertell, who formerly rep-



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A dependable remote control switch. Used with any Minneapolis Thermostat, it is ideal equipment for control of electrical apparatus where temperature change is a factor. Operates on an entirely new and approved principle. Transformer is built into the relay, providing 7½ volts for the thermostatic circuits. Main switch operates on 110 volts. Switch works unfailingly. So constructed as to make it impossible to stick in neutral position. Power is furnished to the solenoids until the action is completed and the circuit changed —a result of exclusive "Minneapolis" construction. No springs to break or weaken. Few moving parts; stands long, hard usage.

For use in connection with automatic oil burners, refrigeration machinery, ventilating equipment, electric ovens for various purposes and other equipment in which control of temperature is necessary.

Users and manufacturers of such equipment are requested to write for descriptive literature, stating purpose for which relay switch is desired.

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The "MINNEAPOLIS" HEAT REGULATOR

The first AIR FILTER in the World

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Boston, 101 Tremont St.
Philadelphia, 1711 Sansom St.
Baltimore, 847 Equitable Bldg.

San Francisco, 61 Freemont St.
New Orleans, 724 Dryades St.

resented the Sprague Electric Works, is acting in a similar capacity for the Engineering Building Equipment Section of the General Electric Company.

Cleveland Gas Burner and Appliance Co., Cleveland, O., manufacturer of Barber patented gas burners and brass and iron machine work, announces that it has created a department in connection with its business which will specialize in the manufacture of special iron and brass parts and special fittings for the heater trade. This service is intended to meet the requirements of manufacturers who have not the necessary foundry and machine-shop equipment, or who have work outside of their own plants.

Trane Co., La Crosse, Wis., manufacturer of the Trane system of vapor heating and the Trane pumps, announces that A. W. Burke, for nine years connected with the Decatur Pump Co., of Decatur, Ill., is now connected with the pump division of the Trane Company, at La Crosse, where he is devoting his time to the introduction of a new vacuum return-line pump. This new pump, it is stated, will give the Trane Company a complete line of vacuum, one and two unit, single and double motor return-line vacuum pumps, as well as air pumps. Announcement of the new pump will be made in the near future.

Uehling Instrument Co., Paterson, N. J., has placed Charles J. Schmid in charge of sales in Greater New York and Long Island, with headquarters in Paterson. The company has appointed John E. Arnold, as its Oklahoma representative, with headquarters in Tulsa, Okla., and H. R. N. Johnson as its representative for Minnesota, North Dakota and South Dakota, with headquarters in Minneapolis. Royal E. Terhune has been placed in charge of the northern New Jersey sales territory.

Central Station Heating Notes.

Gordon, Neb.—A plan to use the exhaust steam from the city's $60,000 steam power plant to heat the business section of the city, was proposed at a recent luncheon of the business men of Gordon and a committee was appointed by Mayor F. L. O'Rouke to look into the matter and report as soon as possible to the city council.

Odessa, Mo.—A district heating system has been proposed for Odessa, to be operated from the ice plant of J. P. Barnes on Mason Street, and to furnish heat to every business house in the four blocks of the main business district.

San Francisco, Cal.—A petition for a revision of the steam heat rates in San Francisco is before the State Railroad Commission. The movement was started by James S. Flannery, manager of the Court Hotel, who is also chairman of a committee of the California Hotel Association which has been investigating steam heating rates and has based its petition on the lower prices now quoted for fuel oil.

New Incorporations.

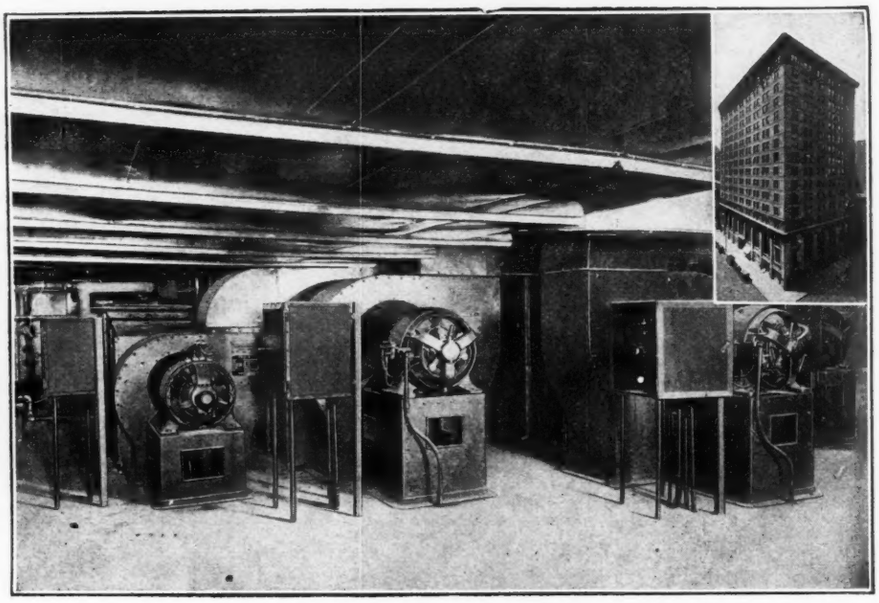
Petroheat, Inc., 2529 Corrington Ave., Evanston, Ill., capital $13.000, to manufacture and deal in heating equipment and to engage in contract work. Incorporators: William Fenner, W. Lawrence Fenner, Evelyn M. Fenner. Correspondents, Evans and Peterson, La Salle and Madison Sts., Chicago.

Business Changes

John Hankin & Brother, New York, heating and ventilating contractors, have moved from West 25th Street to 228 Cherry Street, their new quarters giving them added conveniences and increased facilities.

REPRESENTATIVE WANTED.—New York representative desired by company manufacturing heating specialties, radiator supply and return valves for steam and hot water. This company has an established reputation for quality and service and a representative is preferred who has an established selling organization in touch with consulting engineers, architects and heating contractors. Liberal commissions will be paid or arrangements made whereby apparatus can be purchased outright at factory prices. Address Remington, care of Heating and Venting Magazine.

VENTILATING EQUIPMENTS



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